# PSYCHE,

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. Nos. 141-142.**

JANUARY–FEBRUARY 1888.



*CONTENTS:*



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20 c

[Entered as second class mail matter.]

# Psyche, A Journal of Entomology.

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# CONTENTS.

PSYCHE.

# ON THE PRESENT STATE OF OUR KNOWLEDGE CONCERNING CONTAGIOUS INSECT DISEASES.

BY STEPHEN ALFRED FORBES, CHAMPAIGN, ILL.

[Annual address of the retiring president of the Cambridge Entomological Club, 14 January 1887.]*

It seems to have been from the beginning characteristic of the Cambridge Entomological Club that, without undervaluing taxonomic work, our members have chosen for themselves the field of biological entomology. Not content with the mere orderly arrangement of the facts of insect structure in the form of a comparative anatomy or of a classification, we have been especially interested, as a rule, I think, in the attempt to philosophize such facts; to trace them to their causes and to follow them to their effects. Sympathizing heartily with this tradition of the society, I have selected as the principal topic of my address a subject requiring us to consider the insect as a living organism, in active vital relation to the living organic world,— a subject which frees us in great measure from the technical harness of a classification, and must even lead us quite beyond the borders of entomological science. It is one of those outlying subjects which come within the range of a *frontier patrol*, interested in the foreign relations of insect life, whether those of peaceful commerce or of depredation and defence. Topics of this sort are the food relations of insects and, allied to this, the captivating subject of their relations to flowers. Here also belongs the complex subject or group of subjects included under economic entomology; and here comes, of course, the special topic of this address, — that of contagious insect disease.

Contagious disease, wherever it has been traced to its origin, has proved to be a phenomenon of parasitism; and is included, consequently, under the general head of the interactions of organisms.

Rejecting the many cases of parasitism which have no very serious effect on the insect host, whether because the parasites are in their nature insignificant, or because — as in the case of the termites and many wood-eating species — the organism seems to have adjusted itself to continuous and extraordinary parasitism; and further excluding — since the outlines of our subject must at best be arbitrary — parasitism by other insects, I shall limit myself to cases of true disease of an epidemic and uncommonly destruc-

* For bibliography accompanying this address see the BIBLIOGRAPHICAL RECORD, p. 15.

tive character which have been traced to fungus or protozoan parasites as their causes.

Within these limits, I will undertake to summarize briefly existing knowledge concerning the leading forms of contagious insect disease, with such references to foreign literature as may be necessary, and with a fuller analysis of our scanty American contributions.

Of the protozoan diseases of insects, *pébrine* of the silkworm is the best known example, — an affection which has for the insect world a character so deadly as quite to overshadow any form of animal parasitism known among human kind. It is a plague rapidly and easily conveyed by contamination of the food, and exceedingly liable to hereditary transmission through infection of the forming egg in the ovary, — differing in this latter respect from any other insect affection known to me.

First clearly distinguished about thirty years ago, it has been thoroughly studied in most of its relations, and is now described, as it occurs in the silkworm, in every general work on silk culture, a very intelligent summary of its characters being given, for example, in Maillot's *Leçons sur le ver à soie du mûrier*. The best detailed description which I have seen of its symptoms and histology is that by Quatrefages in his *Études sur les maladies actuelles du ver à soie** (p. 229-306), to be read, however, in connection with Pasteur's critical remarks in his *Études sur lès maladies des vers à soie* (v. 1, p. 99-106).

Its most evident symptoms are, externally, the peculiar black specking of the skin, from which it derives its name, and, internally, the appearance of similar black spots on the organs generally; and, in the blood, of the peculiar spores of parasites ("corpuscles" of Cornalia) to be mentioned later. Its characteristic pathological features are (1) the more or less extensive disorganization of the gastric epithelium, within whose cells the parasites begin their development; and (2) the general invasion of nearly all the internal tissues by these parasites and their spores, which also become abundant in the blood. At death the body has a certain elasticity quite in contrast with the flaccid condition of larvae dead with other forms of contagious disease. After death it mummifies without decay, and without that efflorescence of spores especially characteristic of muscardine and allied diseases.

The food of healthy insects may become infected by the discharges of diseased larvae, or even, at a considererable distance, by the dust of their excrement. The "germs" of the disease may also be introduced by means of accidental punctures of the skin, as larvae crawl over each other with claws soiled with their spore-laden excrement.

Concerning the characteristic para-

*Memoires de l'Académie des sciences de l'Institut impérial de France, tome 30.*

sites of this disease, an unusual number of conflicting views have been held by successive writers. Leydig was the first to suggest their affinity with the psorosperms of fishes in 1857, but they were afterwards claimed by botanists and described, once as an alga (*Panhistophyton ovatum*), by Lebert, and again by Naegeli, as one of the Schizomycetes or bacteria (*Nosema bombycis*). Even in so recent and authoritative a work as that by Cornil and Babes, *Les bactéries, et leur rôle dans l'anatomie et l'histologie pathologiques des maladies infectieuses*, published in 1885, this view of Naegeli is taken, and the spores are classed as bacteria. But, since the thorough-going researches of Balbiani on their life-history, continued from 1867 to 1883, I think that there can be no longer a reasonable doubt of their animal nature, or of their agreement in general characters with those forms now commonly included under the head of *sporozoa*,— a parasitic subdivision of the protozoa, of which *Gregarina* is perhaps the best known type.

The fullest and most satisfactory account of their very simple life-history is that given by Balbiani three years ago, in his discussion of the *Microsporidia* in the *Journal de micrographie* (1883, v. 7, p. 313-323, and p. 404-411). It may be thus briefly summarized: —

The minute oval spores, colorless, highly refractile, homogeneous in appearance, 4 μ long by 2 μ wide, when swallowed with the food, penetrate in some way unexplained the cuticle of the alimentary canal, and, in the cells of its epithelium, open at one end and emit their contents, each in a form of an amoeboid speck of protoplasm. This grows to a spherical body and, by a process of internal segmentation common to the *sporozoa*, is soon converted into a mass of spores, each like the original. These spores everywhere undergo a like development, and load all the tissues with their products, slowly and gradually arresting all the functions of life. Their vitality is temporary—Pasteur's experiments showing that they will not germinate five weeks after drying out — and the disease is consequently maintained only by virtue of its hereditary character.

This microsporidion, or an extremely similiar one, produces an epizootic disease also in the oak silk-worm (*Attacus pernyi*), in France, in that species, however, being unable to penetrate beyond the epithelial layer of the intestine, and hence not appearing in the blood or in the tissues at large. Other forms of microsporidia have been found in *Coccus hesperidum*; in *Tipula pratensis*; in *Zygaena filipendula*; in two orthopterous insects (*Decticus griseus* and *Gryllus campestris*); in *Emus olens*, a coleopterous species; in the arachnid *Epeira diadema*; in the entomostraca, *Polyphemus pediculus*, *Simocephalus vetulus* and *Chydorus sphaericus*; in the genital tubes of a nematoid worm; and even, according to Vlacovich, in a colubrine snake (*Coluber carbonarius*).

That epizootic attacks are not more

frequently caused by them, is doubtless due to the sparse distribution and the isolated occurrence of many of these species.

Balbiani gives us in his latest work on this subject the interesting and important information that he has often succeeded in conveying *pébrine* to other insects by treating their food with the dejections of affected silkworms. *Bombyx neustria* he found more susceptible than the silkworm itself, but another bombycid, *Liparis chrysorrhoea*, proved wholly refractory, seemingly because the cuticular lining of the intestine is there unusually thick. Dipterous maggots, larvae of ants, and the meal worm (*Tenebrio molitor*) were also used by him in similar experiments, but quite without result.

I have myself, this year, attempted to convey *pébrine* of the silkworm to various other species, obtaining my material for infection from pupae a few days dead, reared by myself from worms conspicuously diseased. Larvae of *Telea polyphemus*, the fall web worm (*Hyphantria textor*), the common cabbage worm (*Pieris rapae*), the caterpillars of the thistle butterfly (*Pyrameis cardui*), various species of cutworms (*noctuidae*), and both adult and larval *Doryphora*, were infected, sometimes by way of the food, sometimes by puncturing the skin, but in every case without positive success. I obtained, it is true, one curious result; my specimens of *Melolontha*, *Pieris*, and *Telea* all developed unmistakably the characteristic specks and spots of *pébrine* subsequent to infection, but the most critical and protracted search of their fluids and tissues failed to discover the slightest evidence of parasitism,—a fact which I could only explain on the hypothesis that the marks on the skin were due to the direct action of the material ingested or injected from the silkworm, and not to any morbific substance elaborated within the bodies of the insects experimented upon.

You will perhaps allow me to add an item upon the possible economic applications of this disease. There is not the slightest probability that the *sporozoa* can be artificially cultivated outside the bodies of the animals which they may infest; neither have we yet any sufficient proof that forms normally occurring in one species will multiply or permanently maintain themselves in any other. We are consequently limited, practically, to artificial measures for developing and accelerating this disease wherever it may be found, and to more careful and extended experiments for its transfer from the silkworm to related noxious species.

The American literature of *pébrine* is an absolute blank, not a single item of new information concerning it having been published on this side of the water, nor a single observation of its occurrence in this country in any other form than in the common silkworm having been placed on record, as far as I can find.

The notable fungous diseases of in-

sects are readily divisible into two principal groups; schizomycoses, produced by bacteria, and hyphomycoses, due to fungi which form a more or less evident mycelium of cylindrical threads (*Hyphomycetes* and *Pyrenomycetes*). These are roughly distinguishable in two important particulars: (1) The bacteria invade the body from within, by way of the alimentary canal; and the thread fungi penetrate from without through the skin or spiracles; (2) Death from a schizomycosis is followed by rapid decay, which soon reduces the tissues to a putrid fluid; while after death from a hyphomycosis the often flaccid body hardens and mummifies without decay, usually swelling to more than its usual size, and frequently becoming covered with a flour-like efflorescence of spores or spore-like bodies. These last characters distinguish the hyphomycoses from the *pébrines*,—the body mummifying in the latter, but shriveling at the same time and never covering itself with spores, unless with those of a common mould of *post mortem* development. Further, the *pébrine* mummy contains only the minute oval spores of the parasite, while that of a hyphomycosis contains either a mass of mycelial threads or large thick-walled, spherical spores,—the lasting spores of an *Entomophthora* or, possibly, both spores and mycelium together.

Muscardine, longest-known of insect diseases — often a cause of astounding destruction both to domesticated and native species, and by far the most promising natural agent for the artificial restriction of noxious insects—is caused by a number of fungous forms—*Botrytis*, *Isaria*, *Cordyceps*,—several species of each—the classification and ontogenetic relations of which are not yet wholly settled. Some *Botrytis* forms have been unmistakably connected with some Isarias as an earlier developmental stage, and other *Botrytis* forms have been as clearly connected with *Cordyceps*, while all the entomochthonous Isarias are classed by Cooke as *Cordyceps* in a vegetative stage; but, on the other hand, the longest-known *Botrytis*—that of silkworm muscardine —has never been followed, that I can find, beyond an *Isaria* stage, and other species are in doubt. Hence, as one consciously beyond the limits of his proper territory, I will touch these dubious and contested matters in the lightest way, endeavoring only to get at and apply the very important entomological data which the cryptogamic botanists have incidentally worked up for us.

Generalizing the life histories of these fungi and their modes of attack on the living insect structure (which is for most of them the indispensable substratum of their later growth), we may say that they invade their hosts from without—or, sometimes, by the spiracles and tracheae — but never, so far as known, by way of the alimentary canal; that their minute spores germinate on the surface and send inward through the cuticle slender threads which grow through the body wall and then separate into small single cells—cylindrical conidia—that these pass everywhere, growing, dividing and again dividing as they go, deriving their nutri-

ment from the tissues and the blood, rendering the latter distinctly acid, as a rule;—and that death slowly supervenes.

After this event, these conidia elongate, producing mycelial threads with which the body soon becomes stiffened and distended. Then they shoot upward through the skin a forest of little stems, fertile hyphae, which may branch much or little, according to the form, often covering the dead insect with a microscropic pile like that of velvet. From these hyphae other spore-like bodies—spherical conidia—are variously budded off, borne on the stems and branches singly, in heaps, in necklace strings, forming finally a dense powdery layer of cell-like particles, white or greenish, often excessively delicate and minute—in the silk-worm species not more than 2 μ or 3 μ in diameter. Here the development may stop—as it usually seems to do, indeed, in the best known form,—the *Botrytis bassiana* of the silkworm muscardine—the conidia detached germinating elsewhere, if they fall on favorable conditions, and directly reproducing this lowly vegetative stage. Under other conditions—sometimes on other insects—(the silkworm fungus on *Gastropacha rubi*, for example)—the fertile hyphae, instead of forming an infinitesimal surface pile, spring up in strong club-shaped tufts, bearing conidia on their threads—this being the so-called *Isaria* stage. Finally, the mycelium within the dead body of the insect may thicken, forming one or more compact masses, from which a strong stipe may spring up—like that from the mouth of the white grub (*Lachnosterna fusca*), of which all have seen examples, or at least illustrations—and at the end of this stipe, immersed in a head more or less distinct, another form of spores—ascospores or thecaspores — may be borne by a more complicated apparatus of reproduction. This is the final reproductive stage—the *Cordyceps*—best illustrated by our *Cordyceps melolonthae** of the common white grubs. These ascospores carry the fungus species over winter; but seem not always necessary to this end, as the spherical conidia of the *Botrytis* stage of the silkworm muscardine have been known to retain their vitality more than a year.

All these reproductive bodies—ascospores and conidia — of *Cordyceps*, *Botrytis*, and *Isaria*, have germinated freely again and again in sweetened water, in sterilized beer-mash, in solutions of gelatine and of gum, and may even grow to some extent in pure water. In these artificial cultures the *Botrytis* stage arises, and may form its spherical conidia in vast abundance; and these have been used with perfect success for the infection of healthy insects in great variety.

Perhaps the most notable of these laboratory experiments have been made by Tulasne, De Bary, and Elias Metschnikoff—names of an authority so high as to leave not the slightest doubt of the correctness of their statements or the soundness of their results. Excluding the experiments of the older authors, made when the existing knowledge of these fungus species was probably insuf-

* SACCARDO, Sylloge fungorum, v. 2, p. 576.

ficient for accurate experiment, we find that these pyrenomycetous fungi have been found in one or more of their stages, spontaneous or as a consequence of experiment, on various hymenoptera, —*vespidae*, *sphegidae*, *formicidae*, *ichneumonidae*,—on larvae of *Papilio*, *Pieris*, *Anthocharis*, *Liparis*, *sphingidae*, *bombycidae* (especially the silkworm and *Gastropacha rubi*), *noctuidae*, and *tineidae* among the lepidoptera,—on dipterous pupae,—on adult or larval *carabidae* (*Calathus*), *staphylinidae*, *coccinellidae*, *melolonthidae* (*Anisoplia* and *Lachnosterna*), and other lamellicorns,—on larvae of *Tenebrio molitor*, *Saperda*, and *Buprestis*, —on *rhynchophora*, including especially *Cleonus* larvae and *Apion*. Various *orthoptera* have been found subject to them,—hemipterous insects,—a *Cicada*, and several *coccidae* (infested by *Sphaerostilbe coccogena*), —and, finally, *Mygale*, *Epeira*, and *Phalangium* among the *arachnida*.

The *Botrytis* and *Isaria* stages are remarkable for the number of insect species which each fungus species may infest,—differing sometimes as widely as larval *tenebrionidae* and *bombycidae*. The fact also that they are not strictly dependent upon living insects as the basis of their growth, but may, at least in the *Botrytis* stage, germinate and form their spherical conidia on moist surfaces elsewhere, makes them especially effective agents of contagion.

Among the most valuable papers on this topic are those by Turpin and by Audouin (Ann. sc. nat.; Zool., 1837, v. 8; and *Comptes rendus*, 1836, p. 170); those by Vittadini (Giorn. Institut. lombard., v. 3, p. 143); by DeBary (*Botanische Zeitschrift*, 1867 and 1869); and by Metschnikoff (*Zoologische anzeiger*, 1880, p. 44).

The American contributions are descriptions of species by Ravenel (Linnæan transactions, 1856, p. 159); descriptions and biological notes by Peck (N. Y state mus. repts. for 1875 and 1879); a description by Peck of a new genus and species of fungus allied to *Cordyceps* (*Appendicularia*) infesting *Drosophila* (Science, v. 4, p. 25); various notes on the prevalence of *Cordyceps melolonthae* Tul., on white grubs—including a mention and figure of this fungus as a new species (*Torrubia elongata* Riley)—in an agricultural weekly; a general article by Riley, on *Cordyceps* (Amer. entom., 1880, v. 3, p. 137); a note by Riley, (Rept. U. S. commiss. agr., 1883, p. 119) reporting the occurrence of spontaneous muscardine on *Plusia rimosella*—the same article containing the description of *Botrytis rileyi* by Dr Farlow; and, finally, an illustrated note on a coccid parasite belonging to *Cordyceps*, by Zabriskie, in the New York journal of microscopy (Vol. 1, 1886, p. 89). Additional minor memoranda will be found in the bibliographical list given with this paper.

The insect diseases which are probably most commonly noticed are those due to the *entomophthoreae*; nine tenths of the adult and larval insects found dead and stiff on fences, weeds, grass, etc., in ordinary collecting, being, according to my observation, victims of

these parasites. They are so well known as represented by the common house-fly fungus, *Empusa muscae*, that I may pass them rapidly by. The insect parasites of this group are variously classified: reduced by Winter to a single genus (1881); distributed by Brefeld (1884) among three genera; and divided by Eidam (1886) into four.

Concerning their methods and apparatus of attack on the insect body, I need only note their similarity to those of the *Botrytis* forms of the preceding group—internal and external conidia, the latter germinating externally or in the tracheae—the penetrating hyphae and subsequent mycelium;—the differences are insignificant to the entomologist. The conidia have, however, this important practical peculiarity; that they very soon lose their power of germination, the species being preserved from year to year by lasting-spores—(large, thick-walled, spherical cells forming within the insect body, dark in some cases, discoloring the blood); or else by the hibernation of diseased individuals, in whose bodies the fungus parasite is preserved until the following year. In grasshoppers, noctuid caterpillars, cicadas, and the like, these lasting spores almost completely fill the body after death, the mycelium which developed them shriveling away. Destructive epidemics due to these fungi have been noticed among grasshoppers—especially *Oedipoda* and *Pezotettix*; among various noctuid larvae—especially *Agrotis segetum* in Europe and some American cut-worms; among the two European cabbage worms (*Pieris rapae* and *P. brassicae*); among various diptera—the common house-fly, blow-flies, *syrphidae*, *Culex*, and even *Chironomus* larvae; and, finally, among *coccidae* and aphides—*Aphis corni* and *Aphis rumicis*—these last occurrences suggesting to the agricultural entomologists of France the use of *Entomophthora* for the destruction of the phylloxera.

These *Entomophthora* forms have proved, thus far, much more difficult of cultivation artificially than the other fungus parasites, the only successful attempt within my knowledge being that made by Brefeld in 1884. In his Entomophthorae (p. 72) he tells us that after many unsuccessful trials he succeeded at last in cultivating them in sterilized veal soup, the mode of growth and of conidia formation being identical with that in the body of the living fly.

In his *Botanische untersuchungen* for 1881 he describes (p. 98) an infection experiment with the conidia of *Entomophthora radicans* applied to one hundred and twenty cabbage caterpillars, with the consequence that eighty-one speedily died of the fungous disease resulting.

In this country, three species only have been described; one by Peck from the *Cicada* (Rept. Botanist, N. Y. state mus. nat. hist., 31, p. 19), first reported, however, by Leidy, in 1851 (Proc. Acad. nat. sci. Philad., v. 10, p. 235); one by Bessey in *Pezotettix* (Amer. nat., v. 17, p. 1280); and one by Arthur from *Phytonomus punctatus* (N. Y. Agr. exper. station rept. 1885, p. 258). The only experimental work attempted here grew out of the

interesting suggestion of the use of yeast as an insecticide, made by Dr. Hagen in 1879, — a suggestion based on the doctrine of Bail (1861) that *Empusa*, *Mucor*, and *Saccharomyces*, (the fly fungus, the common moulds, and the yeast plant), were merely different forms of the same species and mutually interchangeable. The practical test of this theory, as made by Riley, Prentiss, Smith, Cook, Willet, and others, failed to justify the method (although the results seem not to have been critically studied with the microscope), and its theoretical foundation has completely vanished, — so high an authority as De Bary referring to it in 1884 as an "item in the history of error" (Morph. und biol. der pilze, p. 172).

And finally we come to schizomycosis, the most interesting, probably the most important, far the most intricate and difficult, and consequently the least understood of the forms of insect disease,—perhaps, also, the one which, when fully investigated, will throw most light on problems of human pathology. It has only been possible within a very few years to study the bacterial diseases of insects satisfactorily, since the research has had to wait for the development of methods of bacterial research in general,— a development which did not really reach a stage of advancement sufficient to yield results that could stand the tests of time and repeated experiment until we had the homogeneous immersion objective and the methods of bacterial culture in solid media. A few conclusions have, however, now been made clear,— chiefly, so far as this particular division of our subject is concerned, by Pasteur and his followers in France.

It was in 1867 that *flacherie* or *morts flat* of the silkworm was first discriminated by Pasteur as a distinct contagious bacterial disease, capable of transmission to healthy larvae by infection of their food either with fresh excrement, or with the dust of infected silkworm nurseries of the year before. His personal researches were summed up in his classical work in two volumes (1870) *Études sur les maladies des vers à soie*, and these were followed by numerous other papers — those of Dr. de Ferry de la Bellone in *Actes et mémoires du Congrès séricicole international* for 1875 and *Comptesrendus sténographiques* of the same congress for 1878, being the ablest and most convincing that have come under my observation. No student of this affection, whose work I have seen, has made a critical botanical study of the species of bacteria involved, but these have been referred to only in general terms which serve to indicate that they include both bacilli and micrococci.

Another more recent and unusually successful research is reported by Cheshire and Cheyne in the *Journal of the Royal microscopical society of London* (v. 5, p. 585), on the disease of bee larvae known as foul brood,—demonstrated by them to be due to an intestinal *Bacillus*.

In America more has been done on these schizomycoses than on any other insect diseases,—chiefly, so far as systematic investigation goes, at the Illinois state laboratory of natural history. Here we have carefully studied jaundice of the silkworm and *flacherie* of

*Pieris rapae* and of *Datana ministra*, repeatedly isolating the bacterial species in pure cultures, fluid and solid, on gelatine films, and in tubes of agar-agar, drawing, photographing, and mounting many slides to illustrate every step of each experiment and finally testing our results, in every case, by applying the supposed disease germs to the food of healthy insects kept in strict comparison with check lots not so treated. By these methods we have clearly discriminated the species of micrococci characteristic of these diseases, as they have occurred with us, and have shown that the spontaneous *flacherie* of some of our common caterpillars may be unquestionably conveyed to other lepidopterous species and even to the white grubs.

All the bacterial diseases of insects thus far carefully studied, take first and principal effect on the epithelial layer of the alimentary canal,—no distinctively blood disease having yet been distinguished, if we except a supposed "*flacherie*" of *Cleonus* larvae reported by Metschnikoff in Russia, but apparently not critically investigated. These alimentary schizomycoses are extremely common affections, attacking native insects in the open air under all ordinary conditions, and are especially liable to appear among larvae in confinement. I have seen wide-spead epidemics of *flacherie* in the caterpillars of *Pieris rapae*, of *Pyrameis cardui*, and of *Nephelodes violans*, and have met it here and there in numbers of other larvae, both lepidopterous and hymenopterous.

For purposes of practical experiment these bacterial diseases have the great disadvantage that they require for the cultivation of their germs, a considerable degree of experimental skill and scientific training. They consequently promise less immediate and satisfactory results than the muscardines.

In conclusion, gentlemen, I think that you will see why, in trying to present this subject to you, I have not followed a common custom by limiting myself to a summary of the results of the most recent researches;—it was because so little is generally known to our entomologists on this topic, that almost nothing entomological has been done. You can hardly have failed to notice that most of what we know, has been acquired by the economists, like Pasteur, or the botanists, like De Bary and Tulasne—either by those generally indifferent to all but the practical end in view, or else by those using the insect organism only as a culture apparatus for the study of the life histories of fungi. But surely the entomological side of the relation is equally interesting and important—with its unsolved questions of physiology and pathology, its bearings on distribution as influenced by meteorological conditions, its promised contributions to a knowledge of the details of the struggle for existence, and of the general system of interactions obtaining among organic beings.

In the strict specialization of modern scientific work, are we not likely to drop many important subjects as between two stools? May we not safely recognize a group of specialties which shall comprise the study of the biological relations of living things, and give to results gathered from this field as cordial and intelligent a reception as to those of the embryologist or the comparative anatomist?

# PSYCHE.

CAMBRIDGE, MASS., JAN.-FEB. 1888.



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## EDITORIAL NOTE.

Unavoidable hindrances have so delayed the issue of volume four of PSYCHE that its publishers deemed it best to begin volume five with the year 1888, omitting the years 1886 and 1887. Volume five will include the years 1888 to 1890. The concluding portion of volume four is now partly printed, but will still require considerable time for completion, on account of the expensive index which will accompany it.

## NOTE ON PELECINUS POLYCERATOR.

In examining a considerable collection of *Pelecinus polycerator* I noticed that every specimen had the enlarged first segment of the abdomen split longitudinally on the back, on or near the median line. The split is sometimes a mere crack, sometimes a wide gap, and in the latter case is often somewhat torn at the ends.

This splitting has often been noticed by others, but I know of no published account of it. It has been suggested that it had some relation to the remarkable scarcity of the male in this species, but the more probable explanation seems to be in the warping caused in drying. Every collector knows how the parts of the ovipositor of the long-tailed ichneumon-flies (*Pimpla*) warp in drying, and I have never noticed a crack in this place in the living *P. polycerator*, altho I have collected a great number of them.

*C: W: Woodworth.*

## FEEDING HABITS OF A LYCAENID CATERPILLAR.

Last spring Mr. Lintner kindly guided me to his happy hunting grounds at Centre, near Albany, N. Y., where for the first time I had the pleasure of making the personal acquaintance of my namesake, *Rusticus scudderii*. I succeeded in obtaining from females enclosed on lupines a large number of eggs and in rearing many caterpillars to maturity.

The caterpillar has a very extensile head and flexible neck, as figured for *L. pseudargiolus* by Mr. W. H. Edwards, and its manner of feeding immediately after birth is rather remarkable; it first pierces the lower cuticle of the leaf, making a hole just large enough to introduce its minute head, and then devours all the interior of the leaf as far as it can reach — many times the diameter of the entrance-hole — so that when the caterpillar goes elsewhere, the leaf looks as if marked with a circular blister or pustule, having a central nucleus, the nearly colorless membranes of the leaf being all that is left at the blister, and at the central entrance to it the upper membrane only. The blister is 1.75 mm. in diameter, and the nucleus-like opening to it only about 0.25 mm. in diameter.

In later life the caterpillar feeds on both surfaces, though it still seems to prefer the under, but eats entirely through the cuticle of the surface on which it feeds, and down to the opposite cuticle which it leaves untouched. It retains, also, to some degree, its habit of thrusting its head between the cuticles to get at the juicier parts; and I have seen one bore out the cut end of a stem down to the rind on every side.

*Samuel H. Scudder.*

## EGG-LAYING OF LIMENITIS DISIPPUS.

On 12 July, in Sugar Hill, N. H., I saw a female *Limenitis disippus* flying heavily over a bank by the roadside. This bank was covered with young poplar shoots, and, seeing the butterfly settle on one of these, I followed her, and saw that she laid an egg on the tip of a leaf and then flew away. Picking the leaf, I followed her to the next shoot which she selected, and continued the chase until I had collected seventeen eggs. Then the butterfly rose higher in the air, flew to an ash-tree, and was hidden in the leaves. A shower was near, and rain began to fall in less than five minutes after she disappeared.

The eggs all hatched in due time, and produced eleven males and six females, all perfect.

One peculiarity of this female was that she laid more than the "one egg at the very tip," which books and pictures have led us to expect.

One leaf had four eggs; one at the tip, two on one edge near the tip, and one on the other edge near the tip. Another leaf had two; one on the tip, the other near it. The third leaf had three irregularly placed near the tip.

Afterwards I found four eggs, two on each side of the tip of a willow-leaf, but these were not near the same place, and were the only eggs of *L. disippus* that I found on willow. I found no larvae on willow, while they were very abundant on poplar shoots close by. In fact *L. disippus* was more abundant this summer than I have ever found it before.

*Caroline G. Soule.*

## A SPHAERULARIA-LIKE WORM.

In the *American naturalist* for January, 1886 (v. 20, p. 73-75), I called attention to some of the peculiarities of *Sphaerularia bombi*, a nematod parasitic internally in species of bumble-bees (*Bombus*), and to the fact that a species of *Sphaerularia* was found in America. One remarkable peculiarity of *Sphaerularia* is that the genital organs of the female evaginate, and form, when they have attained their full size, a worm-like body. The evaginated ovary is so large in proportion to the worm itself, that the latter was, for a time, overlooked by naturalists, and the evaginated portion was described as a worm.

Professor R. Leuckart, whose researches have done much towards completing our knowledge of the life-history of *Sphaerularia*, has published, in the *Zoologischer anzeiger* (20 Dec. 1886, v. 9, p. 743-746), a preliminary communication entitled, "Ein spaerulariaartiger neuer nematode," in which he gives an account of the structure and habits of a nematod allied to *Sphaerularia*, to which he gives the name of *Asconema gibbosum*. This worm was discovered in the body-cavity of *Cecidomyia pini*, even in the larval state. The worm is about 0.6 mm. long, and the adult female bears, upon the ventral surface near the posterior extremity, a bean-shaped process about 0.25 mm. long. The digestive tract does not form a tube in the adult, but is reduced, as it is in *Sphaerularia*, to a chain of large cells.

The eggs of *Asconema* fall into the body-cavity of their host, the *Cecidomyia*, where they hatch, but the young do not reach their sexual development until they are set free from the host, by the death of the latter. Sexual union takes place within a few days after the *Asconema* are free from their host. After this the males die and the females that get the opportunity pass into the *Cecidomyia* larvae, which inhabit soil composed of decaying pine-needles. Again in the body-cavity of a *Cecidomyia*, the female develops and evaginates its genital organs, while the digestive tract becomes rudimentary. The ovaries of *Asconema* are not so large as those of *Sphaerularia*; while the latter worm requires a year for its development, *Asconema* develops in a few weeks.

*G: Dimmock.*

## BIBLIOGRAPHICAL RECORD.

*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name, as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic; G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

### Contribution to American Bibliography of Insect Diseases.

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On a specimen from Guadeloupe in the collection of the Lyceum of natural history of New York. On *sphaeria entomorhiza* Dickson, *s. militaris* Persoon, and *isaria sphingum* Schweinitz;—the latter is always found upon the body and wings of sphinges hanging with outspread wings on twigs.

*S. A. F.* (4301)

#### 1827.

**Mitchill**, S: Latham. Views of the process in nature by which, under particular circumstances, vegetables grow on bodies of living animals. (Amer. journ. sci. and arts, June 1827, v. 12, p. 21-28.)

Mention of *cordyceps* on *melolontha* from Virginia and on various exotic insects. General discussion.

*S. A. F.* (4302)

#### 1849.

**Leidy**, Joseph. Descriptions of new genera and species of entophyta. (Proc. Acad. nat. sci. Philad., 25 Dec. 1849, v. 4, p. 249-250.)

Descriptions of filamentous fungi from the alimentary canal of species of *julus* and *passalus*. *S. A. F.* (4303)

#### 1850.

**Brown**, Buckminster. [Remarks on a caterpillar fungus (*spheria robertsii*) from New Zealand. (Proc. Boston soc. nat. hist., Dec. 1850, v. 3, p. 341, 4 lines.)

*S. A. F.* (4304)

#### 1851.

**Leidy**, Joseph. [Remarks on parasitism of insects.] (Proc. Acad. nat. sci. Philad., 1851, v. 5, p. 204, 210, 211,)

Account of culture experiment with fungus of mole cricket. Dr. Leidy remarks that amount of parasitism in insects is influenced by kind of food. Hemipterous insects remarkably free from parasites; those eating decaying substances especially subject to them.

*S. A. F.* (4305)

**Leidy**, Joseph. [*Cicada septendecim* affected by a fungus.] (Proc. Acad. nat. sci. Philad., 1851, v. 5, p. 235.)

Brief description of spores. Also mention of fungus attacking lamellicorn larvae and mole cricket (*gryllotalpa*). *S. A. F.* (4306)

#### 1853.

**Leidy**, Joseph. A flora and fauna within living animals. (Smithsonian contributions to knowledge, Apr. 1853, v. 5, art. 2, 67 p., 10 pl.)

An elaborate, illustrated article on fungi normally inhabiting the alimentary canal of various insects and myriopods. *S. A. F.* (4307)

#### 1854.

**Wyman**, Jeffries. [Remarks on growth of parasitic fungus (*empusa*) upon the common house-fly.] (Proc. Bost. soc. nat. hist., Dec. 1854, v. 5, p. 90.)

*S. A. F.* (4308)

#### 1856.

**Glover**, Townend. [Note on disease of caterpillar.] (Rept. [U. S.] Commissioner of patents for 1855—Agriculture, p. 91.)

Mention of destructive disease among caterpillars of an unknown species in South Carolina.

*S. A. F.* (4309)

### 1865.

**Kirtland**, Jared P. Pear-tree blight—concerning its cause and cure. (Prairie farmer, 29 July 1865, v. 16, p. 71.)

Brief reference to *cordyceps* on *melolontha* larvae. *S. A. F.* (4310)

### 1867.

**Shimer**, H: Notes on *micropus* (*lygaeus*) *leucopterus*, Say, "the chinch bug." With an account of the great epidemic disease of 1865 among insects. (Proc. Acad. nat. sci. Philad., May 1867, [v. 19], p. 75–80.)

Description of this "disease," not at present identifiable. *S. A. F.* (4311)

**Walsh**, B: Dann. A plant growing out of an insect. (Practical entom., Aug.-Sep. 1867, v. 2. p. 116.) (Amer. entom., Dec. 1868, v. 1, p. 77.)

On *cordyceps* from Iowa. Large numbers of infested white grubs turned up by plow. Writer supposes that the grub has eaten poisonous seed, which has germinated after killing the insect. Hopes that kind of seed may be discovered and sown where grubs are abundant *S. A. F.* (4312)

### 1869.

**Walsh**, B: Dann *and* Riley, C: Valentine. Fungoid growths. (Amer. entom., Jan. 1869, v. 1, p. 91–92.)

Publication of and remarks on a communication from S: H. Y. Early. Fungoid growths on white grub very common in Virginia, and believed to produce a poisonous mushroom. *S. A. F.* (4313)

**Ratzeburg**, Julius Theodor Christian. [Fungoid parasitism of insects.] (Proc. Bost. soc. nat. hist., Apr. 1869, v. 12, p. 381.)

Letter to Dr. H. A. Hagen quoted. Finds an inverse relation between parasitism by insects and by fungi. *S. A. F.* (4314)

### 1872.

**Murie**, James. On the development of vegetable organisms within the thorax of living birds. (Monthly micros. journ., 1 Apr. 1872, v. 7, p. 149-155, pl. 12.)

Mention of fungi as occurring in insects. *S. A. F.* (4315)

**Packard**, Alpheus Spring, *jr.* 2nd ann rept. on the injurious and beneficial insects of Massachusetts, Boston, 1872, p. 4–5.

Several thousand dollars' worth of silkworms killed at East Medford, Mass., by imported *pebrine*. *S. A. F.* (4316)

### 1873.

**Leconte**, J: Lawrence. Hints for the promotion of economic entomology. (Proc. Amer. assoc. advanc. sci., for 1873, 1874, v. 22, pt. 2, p. 10–22.)

Mentions the destruction, by *pebrine* or *muscardine* from silk-worms, of the caterpillars on nine acres of forest. *S. A. F.* (4317)

### 1874.

**Burrill**, T: Jonathan. [Chrysomelid larva attacked by a fungus.] (Colman's rural world, 15 (?) May 1874, v. —, p. —.)

*Cordyceps* on a larva resembling that of *diabrotica vittata*. *S. A. F.* (4318)

**Burrill**, T: Jonathan. White grub in Illinois. (Cultivator and country gentleman, 27 Aug. 1874, v. 39, p. —.)

Mention of *cordyceps*. *S. A. F.* (4319)

**Riley**, C: Valentine. The unadorned tiphia or white grub parasite: *tiphia inornata* Say. (6th ann. rept. state entom. Missouri, Jefferson City, 1874, p. 123–126, fig. 34–35.)

Mention of *torrubia militaris* (possibly *t. cinerea*) as a white grub parasite. *S. A. F.* (4320)

### 1875.

**Peck**, C: Horton. Report of the botanist. (28th ann. rept. N. Y. state mus. nat. hist., for 1874, 1876), p. 70.

Description of *torrubia superficialis* n. sp. from dead larvae. *S. A. F.* (4321)

**Riley**, C: Valentine. *Torrubia elongata*, the white grub fungus. (Colman's rural world, 12 June 1875, v. —, p. —.)

Name of *torrubia elongata* proposed for white grub fungus. Figures from specimens obtained in Missouri. *S. A. F.* (4322)

### 1876.

**Mann**, B: Pickman, Notes on the white mountain faunae. (Psyche, July 1876, v. 1, p. 183-184.)

*Syrphus* found infested by fungi (*entomophthorae ?*) *S. A. F.* (4323)

### 1877.

**Cooke**, Mordecai Cubitt. The hyphomycetous fungi of the United States. (Bull. Buffalo soc. nat. sci., 1877, v. 3: Feb., p. 189–192; Jul., p. 193–202.)

Five species of entomochthonous *isaria* mentioned on p. 189. *S. A. F.* (4324)

**Riley**, C: Valentine. [Note on the development of *torrubia elongata*.] (N. Y. weekly tribune, 4 Oct. 1877, v. —, p. —.) *S. A. F.* (4325)

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**Saunders**, W: The annual address of the President of the Entomological Society of Ontario. (Can. entom., Oct. 1878, v. 10), p. 183. ([9th] ann. rept. Entom. soc. Ont., 1878), p. 5.

Report of destructive disease (muscardine?) among nearly full-grown larvae of *Clisiocampa sylvatica*. *S. A. F.* (4327)

## 1879.

**Comstock**, J: H: Report upon cotton insects . . . Washington, 1879, p. 217.

Report of unsuccessful experiments with yeast applications to cotton-worms (*aletia*), made to test Hagen's proposed method of instituting fungus disease.
*S. A. F.* (4328)

**Comstock**, J: H: [Entomological note.] ([10th] ann. rept. Entom. soc. prov. Ontario 1879), p. 22.

Unsuccessful experiments with yeast as an insecticide. *S. A. F.* (4329)

**Comstock**, J: H: Fungi as insecticides. (Rept. [U. S.] Commiss. agric., 1879, p. 260–261.)

Abstract of unsuccessful experiments with yeast fungus, by A. N. Prentiss, in the application of yeast-fungus to plant lice, scale insects, and red spiders.
*S. A. F.* (4330)

**Gerard**, W. Ruggles. The *saprolegnia ferax*. (Proc. Poughkeepsie soc. nat. sci., 18 Dec. 1878, v. 4, p. 25–28.)

Life history of *empusa muscae*, on supposition of its connection with *saprolegnia ferox* as a terrestrial state.
*S. A. F.* (4331)

**Hagen**, Hermann August. Obnoxious pests: Suggestions relative to their destruction. (Can. entom., Jan. 1879, v. 11, p. 110–114.) ([10th] ann. rept. Entom. soc. prov. Ontario, 1879, p. 22–24.)

Summary of studies by Dr. Theodor Bail tending to show that *mucor*, *saprolegnia*, *saccharomyces*, and *empusa* are different forms of the same fungus species, and that insects may become infested with fungi if fed with beer mash. Use proposed against injurious insects generally. *S. A. F.* (4332)

**Hagen**, Hermann August. Les insectes nuisibles. (Nat. can., 1879, v. 11, p. 150.)

French translation of article in the *Canadian entomologist* of this year, on yeast as an insecticide.
*S. A. F.* (4333)

**Hagen**, Hermann August. Destruction of obnoxious insects, phylloxera, potato beetle, cotton-worm, Colorado grasshopper, and greenhouse pests, by application of the yeast fungus. Cambridge, 1879, 11 p.

Revised edition of the article on this subject in the *Canadian entomologist*, with additions relating to experiments—one of them apparently partially successful. *S. A. F.* (4334)

**Peck**, C: Horton. Report of the botanist. (31st ann. rept N. Y. state mus. nat. hist., for 1877, 1879), p. 19. (Hedwigia, Oct. 1881, v. 20, p. 154.)

"Seventeen-year locust" (*cicada septendecim*) affected by a fungus. Description of entomophthorous attack. Suggests that it may ordinarily occur on other species of *cicada*. *S. A. F.* (4335)

**Saunders**, W: Annual address of the president of the Entomological society of Ontario. (Can. entom. Oct. 1879, v. 11), p. 186–187. ([10th] ann. rept. Entom. soc. prov. Ont., 1879), p. 7–8.

Further report of a disease among nearly grown larvae of *clisiocampa sylvatica* in Canada.
*S. A. F.* (4336)

**Siewers**, C: Godfrey. Mold as an insect destroyer. (Amer. nat., Nov. 1879, v. 13, p. 681–683.)

Hagen's theory reiterated. Various instances reported of occurrence of fungous disease among larvae.
*S. A. F.* (4337)

## 1880.

**Aitken**, J: Notes on a new species of caterpillar fungus. (Hardwicke's science gossip, 1880, p. 97-98.) [not seen.]

On *torrubia* sp. *S. A. F.* (4338)

**Hagen**, Hermann August. Schädliche insecten durch den hefenpilz zu tödten. (Zool. anzeiger, 19 April 1880, v. 3, p. 185.)

Report of successful experiment with yeast fungus for destruction of *doryphora 10-lineata*, all treated dying in eight to twelve days and a check lot living through the winter. Hagen regards experimental recommendation as independent of theoretical explanation derived from Bail. *S. A. F.* (4339)

**Hagen**, Hermann August. Ueber die vernichtung schädlicher insecten durch den hefenpilz. (Entom. zeit. . . . zu Stettin, July-Sept. 1880, v. 41, p. 355-357.)

Notice. (Berliner entom. zeitschr., 1881, v. 25, p. 295.)

*S. A. F.* (4340)

**Hagen**, Hermann August. On the destruction of obnoxious insects by yeast. (Can entom., May 1880, v. 12, p. 81–83.)

Experiments by Mr. J. H. Burns with yeast plant on *doryphora*. Fifty treated beetles all died by the twelfth day, while only three of the check lot of fifty had died in six weeks, and only twenty-five died during the following winter and spring. Writer mentions also a seemingly successful experiment on aphides. Summarizes some recent European contributions to life histories of *entomophthorae*. Declares experimental results independent of Bail's theory; and reports finding fungus spores in sinus of wings of dead beetles which had been sprinkled with yeast. Successful use of yeast on aphides reported by letter from Germany.
*S. A. F.* (4341)

**Hagen**, Hermann August. *Cordyceps ravenelii* on the larvae of *phyllophaga*. (Can. entom., May 1880, v. 12, p. 89.)

*Cordyceps ravenelii* received from Alabama. Curtis's description quoted. *S. A. F.* (4342)

**Leconte**, J: Lawrence. Fungoid diseases of insects: a reclamation. (Can. entom., Jul. 1880, v. 12, p. 126–128.)

Comparison of author's own first mention of fungus parasites as insecticides (see Leconte, 1873) with that of Walsh (see 1867). *S. A. F.* (4343)

**Packard**, Alpheus Spring, jr. [Yeast fungus as an insecticide.] (Amer. nat., Feb. 1880, v. 14, p. 133–134.]

Mere mention. *S. A. F.* (4344)

[**Peck**, C: Horton.] Fungi as insect destroyers. (Amer. nat., May 1880, v. 14, p. 363-364.)

Reprint from Bulletin of Torrey botanical club concerning Peck's observations on *cicada* fungus. *S. A. F.* (4345)

**Riley**, C: Valentine. The white grub fungus. (Amer. entom., June 1880, v. 3, p. 137–140, fig. 53–55.)

General article, illustrated summary of literature, and list of entomogenous species of *cordyceps*. Quotes Berkeley's description of *cordyceps ravenelii* and gives American bibliography of the genus. *S. A. F.* (4346)

**Prentiss**, Albert Nelson. Destruction of obnoxious insects by means of fungoid growths. (Amer. nat., 1880, v. 14: Aug., p. 575–581; Sep., p. 630–635.)

Full account of experiments with yeast on aphides, coccids, and red spiders. *S. A. F.* (4347)

**Riley**, C: Valentine. Yeast ferment: fungus infection. (Bull. no. 3, U. S. Entom. comm, Washington, 1880, p. 68–74.)

Report of experiments with yeast made according to Dr. Hagen's suggestion. Riley quotes at length from Hagen; describes unsuccessful experiments on larvae of *papilio, danais*, and *pieris;* and gives a full account of a trial with cotton worms (*aletia*) by Prof. J. E. Willet. Mentions incidentally the occurrence of destructive disease among cabbage worms (*pieris rapae*). *S. A. F.* (4348)

**Riley**, C: Valentine. Fungus diseases of insects. (Amer. entom., Apr. 1880, v. 3, p. 103.)

Abstract of article by Metschnikoff in *Zoologischer anzeiger*, 1880, p. 44, relating to insect diseases in Europe, and experiments with muscardine fungi. *S. A. F.* (4349)

**Riley**, C: Valentine. The use of fungus growths to destroy insects. (Amer. entom., Nov. 1880, v. 3, p. 269–270.)

Abstract of article by A. N. Prentiss, in *American naturalist* this year. *S. A. F.* (4350)

**Schwarz**, Eugene Amandus. Disease of *chauliognathus* larvae. (Amer. entom., Nov. 1880, v. 3, p. 277.)

Note on disease causing larvae to die without subsequent efflorescence of spores. *S. A. F.* (4351)

**Seaman**, W: H. Some remarks on fungi considered as insecticides. (Amer. entom., Feb. 1880, v. 3, p. 40-41.)

Statement and criticism of Hagen's view of relations of yeast fungi to insect diseases. *S. A. F.* (4352)

**Willet**, J. E. *and* **Cook**, Albert J: Experiments with yeast ferment on various insects. (Amer. entom., Dec. 1880, v. 3, p. 289–290.)

Experiment on cotton worms (*aletia*) by Willet, with beer and yeast. Larvae treated with beer all lived to the imago; while of those treated with yeast five died either as larvae or pupae. Experiment not regarded as successful. Entirely unsuccessful experiments by Cook with yeast on squash bugs (*anasa*), potato beetles (*doryphora*), cabbage worms (*pieris rapae*), and plant lice (*eriosoma tessellata*). *S. A. F.* (4353)

## 1881.

**Bessey**, C: Edwin. Insect destroying fungi. (Amer. nat., Jan. 1881, v. 15, p. 52–53.)

Abstract of article by Giard on life history of *empusa*. Mention of description of *cicada* fungus by C. H. Peck. *S. A. F.* (4354)

**Leidy**, Joseph. Parasites of the termites. (Journ. Acad. nat. sci. Philad., 1881, s. 2., v. 8, p. 425-447, pl. 51-52.)

Excessive normal parasitism of *protozoa* in termites. *S. A. F.* (4355)

**Osborn**, Herbert. Occurrence of a bacterial disease in the bronze-colored cut-worm (*nephelodes violans* Guenée). (Iowa homestead, 17 June 1881, v. —, p. —.) (1st ann. rept. N. Y. state entom., Albany, 1882, p. 105.) *S. A. F.* (4356)

**Vorce**, C. M. Wholesale destruction of acari by a fungus. (Proc. Amer. soc. microscopists, 1881, v. 4, p. 49-50.) (Amer. monthly micros. journ., Sept. 1881, v. 2, p. 166–167.)

Dead mites observed filled with fungus spores. *S. A. F.* (4357)

## 1882.

**Forbes**, Stephen Alfred. *Bacterium* a parasite of the chinch bug. (Amer. nat., Oct. 1882, v. 16, p. 824–825.)

Observation of bacteria in alimentary canal of chinch bugs (*blissus leucopterus*) apparently affected by disease. *S. A. F.* (4358)

**Forbes**, Stephen Alfred. Studies on the chinch bug: 1. (12th rept. State entom. Ill., for 1882, 1883), p. 47-57.

Account of apparent disease among chinch bugs (*blissus leucopterus*) characterized by intestinal *micrococcus* described by T: J. Burrill as *micrococcus insectorum*. *S. A. F.* (4359)

**Hagen**, Hermann August. Experiments with yeast in destroying insects. (Can. entom., Feb. 1882, v. 14, p. 38–39.) ([13th] rept. Entom. soc. Ontario, 1882, p. 29–30.)

Publishes, with comments, letter from horticulturist giving result of experiments with yeast fungus,—one apparently successful, others without effect. Reports similar variable results from Germany. *S. A. F.* (4360)

[**Hagen**, Hermann August. On the destruction of insect pests by the application of yeast.] (Amer. monthly micros. Journ., Sept. 1882, v. 3, p. 179.)

Brief mention of Hagen's views. *S. A. F.* (4361)

## 1883.

**Bessey**, C: Edwin. A new species of insect-destroying fungus. (Amer. nat., Dec. 1883, v. 17, p. 1280–1281, 1286.) Bull. Iowa agric. coll.; Dept. entom., 1884, No. 2, p. 84–85.)

Description of *entomophthora calopteni* n. sp. *S. A. F.* (4362)

**Bessey**, C: Edwin. [*Entomophthora calopteni* parasitic on *caloptenus differentialis.*] (Scientific and literary gossip, 15 Dec. 1883, v. 2, p. 40.) *S. A. F.* (4363)

**Burrill**, T: Jonathan. New species of *micrococcus* (*bacteria*). (Amer. nat., March 1883, v. 17, p. 319–320.)

Original description of *micrococcus insectorum* from chinch bug (*blissus leucopterus*). *S. A. F.* (4364)

**Cook**, Albert J: The bee-keepers' guide, or Manual of the apiary. 9th ed. 1883, p. 309, 310.

Remarks on foul brood of bees. *S. A. F.* (4365)

**Forbes**, Stephen Alfred. Experiments with diseased caterpillars. (Science, 5 Oct. 1883, v. 2, p. 483–484.)

Preliminary note on bacterial disease of native caterpillars. *S. A. F.* (4366)

**Forbes**, Stephen Alfred. A new insect disease. (Prairie farmer, 6 Oct. 1883, v. —, p. —.)

*Flacherie* of *pieris rapae.* *S. A. F.* (4367)

**Forbes**, Stephen Alfred. Memoranda with regard to the contagious diseases of caterpillars and the possibility of using the virus of the same for economic purposes. (Amer. nat., Nov. 1883, v. 17, p. 1169–1170.) (Can. entom., Sep. 1883, v. 15, p. 171–172.)

Abstract of article read at Minneapolis meeting of the A. A. A. S. *S. A. F.* (4368)

**Forbes**, Stephen Alfred. On a contagious disease of caterpillars. (Trans. Ill. hort. soc., 1883, p. 29.)

General article, giving account of results of original observations and experiments. *S. A. F.* (4369)

DE **La Cour**, J. L. *Sporendonema;* or the fungus which is now so prevalent among house-flies. (Amer. monthly micros. journ., Jan. 1883, v, 4, p. 19.)

Rehearsal of general facts concerning *Empusa muscae.* *S. A. F.* (4370)

**Osborn**, Herbert. An epidemic disease of *caloptenus differentialis.* (Bull. Iowa agric. coll.; Dept. entom., Aug. 1884, no. 2, p. 83–86.) (Amer. nat., Dec. 1883, v. 17, p. 1286–1287.)

Account of entomophthorous disease generally prevalent in central Iowa, affecting *caloptenus differentialis.* *S. A. F.* (4371)

**Riley**, C: Valentine. [Remark on an epidemic disease of *caloptenus differentialis.*] (Amer. nat., Dec. 1883, v. 17, p. 1287.) (Bull. Iowa agric. coll.; Dept. ent., Aug. 1884, no. 2, p. 85.)

Riley surmises that insects died from insect parasitism, and that *entomophthora* is a later development. *S. A. F.* (4372)

**Riley**, C: Valentine. The cabbage plusia. (Rept. [U. S.] Commiss. agric.. 1883), p. 121.

Fungus disease reported. Parasite described by Farlow as *botrytis rileyi.* *S. A. F.* (4373)

## 1884.

**Burrill**, T: Jonathan. Experiments in silk culture. (12th rept. Board of trustees Ill. industrial univ., 1884, p. 85–92.)

Account of contagious disease of silkworm which destroyed all but a few hundred of about 80,000 worms hatched for an experiment in silk culture. General discussion of *flacherie* of silkworm. *S. A. F.* (4374)

**Fletcher**, James. [Muscardine in *agrotis fennica.*] (Can. entom., Nov. 1884, v. 16, p. 214.) (15th ann. rept. Entom. soc. Ontario, 1885, p. 21.)

Destruction of great numbers of larvae of *agrotis fennica* by an *entomophthora.* *S. A. F.* (4375)

**New York microscopical club.** [Proceedings] June 6. (Science, 4 Jul. 1884, v. 4, p. 25.)

Account, by J. L. Zabriskie, of a coniomycetous fungus on *drosophila*, a few specimens having been found in the state of New York; and description, by C: H. Peck, of this fungus as a new genus and species (*appendicularia entomophila*) allied to *cordyceps.* *S. A. F.* (4376)

**Wright**, R. Ramsay. [On the corpuscles of *pébrine.*] (Scientific and literary gossip, 15 Jan. 1884, v. 2, p. 70–71.)
*S. A. F.* (4377)

## 1885.

**Arthur**, Joseph C: Disease of clover-leaf weevil: *enthomophthora phytonomi*, Arthur. (4th ann. rept. N. Y. Agric. exper. station for 1885, 1886, p. 241–265, fig. 10.)

p. 258. Illustrated account of an epidemic disease, with description and figures of the *entomophthora* concerned. No resting spores found.
*S. A. F.* (4378)

**Fyles**, T: W. [Fungous disease upon the cutworms.] (15th ann. rept. Ent. soc. Ontario 1885, p. 22.)

Mention of occurrence of insect disease in England.
*S. A. F.* (4379)

**Lintner**, Joseph Albert. [The seventeen-year locust] destroyed by a fungus. (2d ann. rept. N. Y. State entom., Albany, 1885, p. 178–179.)

Quotation from Peck, 1879: in 31st ann. rept. on New York State museum of natural history.
*S. A. F.* (4380)

**Saunders**, W: On some of nature's methods of subduing injurious insects. (Trans. Amer. hort. soc., 1885, v. 3, p. 178.)

Mention of fungus disease of *clisiocampa sylvatica* and *agrotis fennica.* *S. A. F.* (4381)

**Saunders**, W: Annual address of the president of the Entomological society of Ontario. (Can. entom., Dec. 1885, v. 17,) p. 237–239.

Remarks on the general subject of insect diseases with notes of recent work done. *S. A. F.* (4382)

**Woodworth**, C: W: Silkworm notes. Silkworm diseases. (Ill. crop prospects, Crop rept., No. 125, 1885, p. 25-26.)

Description of jaundice of silk-worm as occurring in experiment at University of Illinois. *S. A. F.* (4383)

**Zabriskie**, Jeremiah Lott. A caterpillar fungus from New Zealand, and some related species of the United States. (Journ. N. Y. micros. soc., Apr. 1885, v. 1, p. 89–94, fig. 1–6.)

*Cordyceps* on caterpillars, white grubs, and a *lecanium.* *S. A. F.* (4384)

## 1886.

**Forbes**, Stephen Alfred. [Flacherie in *pieris rapae.*] ILLINOIS—*State entomologist.* Miscellaneous essay's on economic entomology, Springfield, Ill., 1886, p. 5–9.)

Elaborate description of the symptoms, anatomical and histological characters of the disease.
*S. A. F.* (4385)

**Forbes**, Stephen Alfred. Studies on the contagious diseases of insects. (Bull. Ill. State lab. nat. his., 1886, v. 2, p. 257–321, 1 pl.)

An elaborate article giving results of observations and author's experimental studies on bacterial disease of *pieris rapae, datana* larvae, *mamestra picta*, and silk worm, with brief account of epidemic of muscardine in *clisiocampa sylvatica.* Illustrated by photographs of *micrococcus* of cabbage worm. *S. A. F.* (4386)

*An additional list of titles referring to American literature of insect diseases will be given in a subsequent numero.*

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**Alexandre**, A. P. Du développement de la forficale auriculaire. D'après les notes de M. Lorenzo Camerano. (Bull. Soc. linn. du nord de la France, 1880, v. 5, p. 55-60.)

Discusses the time of oviposition and the form of the eggs of *forficula auricularia*, the care of the eggs by the adult, the hatching and molting of *forficula* larvae, and the food of *forficula.* *G: D.* (4387)

**Belon**, Marie Joseph. Histoire naturelle des coléoptères de France. Famille des lathridiens. 2me partie. (Ann. Soc. linn. de Lyon, 1884, 1885, n. s., v. 31, p. 61-212.)

Synopsis of the genera and species of *lathridiidae* of France, with extended descriptions of the species, notes on their synonymy and habitats; the following North American species are included: *corticaria grossa* Lec. [= *c. pubescens* Hummel], *c. fulva* (? N. A.), *c. serrata*, *c. elongata*, *c. deleta* Mann. [= *c. fenestralis* Linn.], *c. pumila* Lec. [= *melanophthalma distinguenda* Comolli]. *G: D.* (4388)

**Bigot**, J. M. F. [Description d'un nouveau genre et d'une nouvelle espèce de diptères.] (Ann. Soc. entom. France, 1884, s. 6, v. 4; Bull. entom., p. 37.)

Describes *cholomyia inaequipes*, a new genus and species of *dexidae* from Mexico. *G: D.* (4389)

**Bigot**, J. M. F. Diptères nouveaux ou peu connus. 24e partie. 32. Syrphidi, 2e partie. Espèces nouvelles, no. 3. (Ann. Soc. entom. France, 1884, s. 6, v. 4, p. 73–116.)

Describes new species of *syrphidae*, as follows: 1 species each of *ischyrosyrphus* and *platycheirus* (from Cal.), 17 species of *melanostoma* (3 from Mexico, 5 from Cal.), 17 of *syrphus* (1 from Mt. Hood, Oreg., 1 from Cal., 2 from Mexico), 10 of *sphaerophoria* (2 from Cal., 5 from Mexico), 15 of *mesograpta* (10 from Mexico, 2 from Cuba), and 1 of *ocyptamus* (from New Caledonia.
*G: D.* (4390)

**Bigot**, J. M. F. [Un nouveau genre de diptères.] (Ann. Soc. entom., France, 1884, s. 6, v. 4; Bull. entom., p. 69–70.)

Describes *ancylogaster armatus*, a new genus and species of *tachinidae* from Mexico. *G: D.* (4391)

**Bonhoure,** Alphonse. Note sur le *platypsyllus castoris* Ritsema et sa capture en France. (Ann. Soc. entom. France, 1884, s. 6, v. 4, p. 147–154, pl. 6.)

Literature of *platypsyllus;* description of *p. castoris* with special reference to its mouth-parts; affinities of the *platypsyllidae* among the coleoptera; notes the discovery of *platypsyllus castoris* on *castor fiber* in France. *G: D.* (4392)

DE **Bruyne,** C. De kerfdieren. Insecta of hexapoda. (Natura, maandsch. voor natuurwetensch., 15 Dec. 1885, v. 3, p. 289–306, pl. 7–8.)

General outline of the anatomy of insects, with figures to illustrate the chief points. *G: D.* (4393)

**Carpentier,** Léon. Chasse d'hiver dans les fourmilières. (Bull. Soc. linn. du nord de la France, 1881, v. 5, p. 212–214.)

Notes on myrmecophilous insects, and on the mode of capturing them in winter. *G: D.* (4394)

**Chambers,** Vactor Tousey. On the antennae and trophi of lepidopterous larvae. (Journ. Cincinnati soc. nat. hist., April 1882, v. 5, p. 5–21, pl. a–c.)

General considerations upon the anatomy and morphology of the mouth-parts of lepidopterous larvae, based, for the most part, on studies of the mouth-parts of *tineina;* 76 figures are given on the plates, illustrating the various mouth-organs of the larvae of lepidoptera. *G: D.* (4395)

**Chambers,** Vactor Tousey. Descriptions of some new *tineina*, with notes on a few old species. (Journ. Cincinnati soc. nat. hist., Jan. 1880, v. 2, p. 179–194.)

Separate, with same title. [Cincinnati, 1880.] n. t.-p., 26 p., 23 × 15, t 17 × 10.5; 58 fig.

Describes 3 new genera, *pluteloptera*, *aetia*, and *eulyonetia*, and new species belonging to these and to the genera *anesychia*, *hyponomeuta*, *gelechia*, *anarsia*, *laverna*, *aeaea*, *elachista*, *lithocolletis* and *nepticula;* notes on other species of *tineina.* [The separate contains this article, p. 1–16, and author's "Illustrations of the neuration of the wings of American *tineina*" (*op. cit.*, p. 194–204) [Rec., 4397], p. 16–20, the figures pertaining to the latter article.] *G: D.* (4396)

**Chambers,** Vactor Tousey. Illustrations of the neuration of the wings of American *tineina.* (Journ. Cincinnati soc. nat. hist., Jan. 1880, v. 2, p. 194–204.)

Separate. (CHAMBERS, V. T. Descriptions of some new *tineina* . . . [Cincinnati, 1880], p. 16–26, fig 1–58.)

Illustrates the neuration of the wings in 58 species of North American *tineina*, with remarks on the same subject. *G: D.* (4397)

**Chivot-Naudé,** A. Notes histologiques. (Bull. Soc. linn. du nord de la France, 1881, v. 5, p. 201–204.)

Includes a description of the eggs of *tipula*, and notes on the structure of the pupal envelope of *tipula.* *G: D.* (4398)

**Cook,** Albert J: Bee-hives and bee-habits. (Science, 5 Feb. 1886, v. 7, p. 127-128, 51 cm.)

Consideration of usefulness of devices for inverting the comb in bee-hives; notes on the mode of oviposition of *apis mellifica* and the relative amount of intelligence and of instinct governing the queen in regulating the sexes of her progeny. *G: D.* (4399)

**Cosson,** C: Moeurs des fourmis. (Feuille des jeunes naturalistes, Sept. 1883, v. 13, p. 139.)

Notes on various habits of *formicidae*, as dependant on their olfactory sense, and on their means of communication. *G: D.* (4400)

VON **Dalla Torre** K: W. Zur biologie von *bombus gerstaeckeri* Mor.: *b. opulentus* Gerst. (Zool. anzeiger, 7 Dec. 1885, v. 8, p. 691–693.)

The females of *bombus gerstaeckeri* found, without exception, gathering pollen from *aconitum lycoctonum* (= *a. ranunculifolium*), while the males and workers gathered pollen, without exception, from *aconitum napellus* and *a. paniculatum;* for this peculiar relationship of the food to the sexes the author proposes the name of heterotrophy; in the case of *b. gerstaeckeri*, as an adaptation to the species of plant visited, the remarkable length (21–23 mm.) of the mouth-parts of the females and the shortness (8–12 mm.) of the mouth-parts of the males are noticed. *G: D.* (4401)

**Dubois,** Michel. Notes sur les insectes habitant les prés salés. (Bull. Soc. linn. du nord de la France, 1880, v. 5, p. 7–9.)

Notes the analogy between the insects of salt marshes and salt lakes and those found on the seacoast. *G: D.* (4402)

**Dury,** C: Coleoptera of the vicinity of Cincinnati. (Journ. Cincinnati soc. nat. hist., Dec. 1882, v. 5, p. 218–220.)

An addition to the author's "List of the coleoptera observed in the vicinity of Cincinnati" (Journ. Cincinnati soc. nat. hist. Oct. 1879, v. 2, p. 162–178) [Rec., 4404]. The present list enumerates 167 species, making, with the other list, a total of 1586 species. *G: D.* (4403)

**Dury,** C: List of the coleoptera observed in the vicinity of Cincinnati. (Journ. Cincinnati soc. nat. hist., Oct. 1879, v. 2, p. 162–178.)

Separate. 17 p. 23 × 16, t 17 × 10.5.

List of 1419 species of coleoptera that have been taken in or around Cincinnati, Ohio. To the list are appended some notes on the habits of a few of the species. *G: D.* (4404)

**Föttinger,** Alexander. Sur les terminaisons des nerfs dans les muscles des insectes. (Arch. de biol., 1880, v. 1, p. 279–304, pl. 10.)

Researches made upon the structure of the nerve-terminations in the muscles of insects—the so-called cones of Doyère—showing that these organs have a transverse striation, as if the muscular disks extended into the termination of the nerve; that the nervous contraction always begins at these cones; and that in the terminal cone the cylinder-axis divides into fibrillae which go to the intermediate disks. *G: D.* (4405)

**Göldi,** Emil A. Aphorismen, neue resultate und conjecturen zur frage nach den fortpflanzungs-verhältnissen der phytophtiren enthaltend. (Mittheil. Schweiz. entom. gesells., Apr. 1885, v. 7, p. 158–166.)

Finds that certain species of *aphididae*, when kept hungry, produced the winged form even as early in the season as June; compares this hastened development with the hastened pupation of lepidopterous larvae when kept hungry, and thus regards the winged *aphididae* as representing the highest development of the insect (a view held by Claus and Leuckart), and not as larvae (as Lichtenstein regards them); notes upon the significance of the absence of the *vesiculae directrices* in arthropoda and rotifera, upon the mouth-parts of *phytophthires*, and upon a peculiar sense-organ of the fifth and sixth segments of the antennae of *schizoneura lanigera*. G: D. (4406)

**Goossens,** Théodore. Les oeufs des lepidoptères. (Ann. Soc. entom. France, 1884, s. 6. v. 4, p. 129–146, pl. 5.)

A general discussion of the eggs of lepidoptera, illustrated by European species for the most part; the author treats of their form, color, polished and dead surface, their fecundity, the duration of incubation and the effect of temperature upon it, the mode of protection of eggs by the parent, and parthenogenesis, and attempts to classify the eggs of certain groups of lepidoptera by their character. The plate contains colored figures of the eggs of 42 species of lepidoptera. G: D. (4407)

**Graber,** Vitus. Vergleichende grundversuche über die wirkung und die aufnahmestellen chemischer reize bei den tieren. (Biol. centralblatt, 1 Sept. 1885, v. 5, p. 385–398.)

Notice. (Entom. nachrichten., Dec. 1886, v. 12, p. 365.)

Crit. rev., by F. A. J. Plateau, entitled, "Une expérience sur la fonction des antennes chez la blatte, *periplaneta orientalis*" (Compte-rend. Soc. entom. Belg., 5 June 1886, p. 118–122).

The author concludes, from a series of experiments here detailed, upon the action of odors in general and upon special organs, that "an absolute sensitive olfactory organ is not present in certain insects, since one set of organs (the antennae) is most sensitive to one odorous material, while another set of organs (the palpi) is most sensitive to another odorous material." G: D. (4408)

**Holmberg,** Eduardo Ladislao. Observations à propos du sous-ordre des araignées territelaires (*territelariae*) spécialement du genre nord-américain *catadysas*, Hentz et de la nouvelle famille *mecicobothrioidae*, Holmb. (Bol. Acad. nac. de ciencias en Córdoba, 1882, v. 4, p. 153–174, pl. 1.)

Notice, by F. A. F. Karsch. (Zool. jahresb. für 1883, 1884, abth. 2, p. 62, 76–78.)

Gives reasons for regarding *catadysas* Hentz as a drassid and a synonym of *zora* Koch and consequently suppresses the sub-family *catadysoides*; erects the new family *t[h]eraphosidae*; erects the new genus *territelarium* and describes and figures *mecicobothrium thorellii*, a new genus and species from the Argentine Republic, for which two genera the author establishes the family *mecicobothrioidae*. G: D. (4409)

**Jung,** ——. [Das wiederaufleben eingetrockneter tardigraden.] (Zeitschr. f. d. gesammt. naturw., 1881, v. 54, s. 3, v. 6, p. 190–192.)

Abstract by R. Vion, entitled "Résurrection des tardigrades par l'humidité." (Bull. Soc. linn. du nord de la France, 1882, v. 6, p. 27–28.)

A species of *milnesium*, after being dried five hours, was restored to full vitality upon the application of moisture. G: D. (4410)

**Keferstein,** [Georg] Adolf. Die schmetterlinge Californiens. (Zeitschr. f. d. gesammt. naturwissensch., 1874, v. 44, p. 222–229.)

Notes on *bombycidae* and *rhopalocera* of California, giving food-plants of some species, based on observations made by Dr. H. Behr. G: D. (4411)

**Keferstein,** [Georg] Adolf. Ueber die tagschmetterlings-gattung. *colias* F. (Verhandl K.-k. zool.-bot. gesells. in Wien, 1882, v. 32; Abh., p. 449–458.)

Arranges the species of *colias* in four groups, and gives their synonymy and varieties. G: D. (4412)

**Langdon,** Frank W. Entomology. (Journ. Cincinnati soc. nat. hist., Dec. 1881, v. 4, p. 345–346.)

Notes on *callosamia promethea* and on *botys langdonalis*. G: D. (4413)

**Langdon,** Frank W. Ornithology. (Journ. Cincinnati soc. nat. hist., July 1882, v. 5, p. 95–96.)

Records having taken a *rallus elegans*, which "had sticking in its oesophagus a large water beetle (*hydrophilus triangularis*), the sharp spine on the ventral surface of the beetle having penetrated the wall of the viscus." G: D. (4414)

**Langdon,** Frank W. A synopsis of the Cincinnati fauna. (Journ. Cincinnati soc. nat. hist., Oct. 1882, v. 5, p. 185–191.)

Gives the number of described species of animals known to the fauna of the vicinity of Cincinnati, including the insects, arachnida, and myriopoda G: D. (4415)

**Lefèvre,** Édouard. [Rectifications concernant la famille des eumolpides.] (Ann. Soc. entom. France 1884, s. 6, v. 4; Bull. entom., p. 45–46.)

Synonymy of some genera and species of *eumolpidae*; among others the following notes refer to species or genera found in North America: *chalcoparia* Crotch = *chrysodina* Baly, and *noda convexa* Say and *n. pilula* Germ. = *n. tristis* Oliv. G: D. (4416)

**Lucas,** [Pierre] Hippolyte. [Note relative à une aranéide.] (Bull. d. séances, Soc. entom. d. France, 1884, no. 22, p. 142–143.)

Notes upon *cyrtocarenum* (*ctenizа*) *californicum*, its habits and nests as observed in confinement. G: D. (4417)

## ENTOMOLOGICAL ITEMS.

*Rovartani lapok*, the Hungarian entomological journal edited by Dr. Géza Horváth, and published at Budapest, ceased to appear with the numero for December 1885, after two years of existence.

PROF. LEWIS R. GIBBES, of Charleston, S. C., reports receiving a specimen of *Heliconia charithonia* from Beaufort, N. C., in 1885. This is the northernmost point at which it has been found. It is rare at Wilmington Island, near Savannah, Georgia, according to Dr. A. Oemler. It is more common at St. Simons Island and Port Royal, S. C., but it is not a common butterfly north of Florida.

PRESERVATION OF LIVING COLONIES OF TERMES LUCIFUGUS.—Dr. G. Horváth, in an article in the numero of *Rovartani lapok* for October, 1885, on the discovery of *Termes lucifugus* in Hungary, states that Lespès, who studied very carefully the anatomy of these insects, was unable to keep living colonies for two months. Horváth, on the other hand, has succeeded in keeping colonies alive for two years, by taking pains to sprinkle the nests each day with a few drops of water.

ENTOMOLOGY IN GEOGRAPHY AND LITERATURE.—Among late contributions to the connection of literature and entomology are two short papers in *Rovartani lapok* for September and October 1885, respectively. The first is a paper by Géza Horváth on the part which the Hungarian names of insects have played in giving names to towns, villages, and farms in Hungary. There are more than a hundred such names. The second is a paper, by Béla Chyzer, "On *coccinellidae* in the infantile poetry of Hungary," in which eight examples are given of children's verses in which the lady-bugs are mentioned.

CHEMICALLY-PRODUCED VARIETIES OF COLEOPTERA. — Mr. Albert Bergé states (Compt-rendu Soc. entom. Belg., for Nov. 1885), that he has been able to produce all the numerous color-varieties of *Carabus auronitens* by chemical means. He does not enter into details of his processes, as he states that he is intending to prepare a more extensive work on the subject, including in it all the coleoptera; but he makes the general statement that alkalies and acids produce colors varying from brown through red to yellow, and that calcic chloride and heat produce all the tints from green to violet. Mr. Bergé does not claim that these varieties are caused in nature in the same way in which he has produced them.

PROF. K. LINDEMAN, in an article entitled, "Die am getreide lebenden thrips-arten Mittelrusslands" (Bull. Soc. impér. natur. Mosc., 1886, v. 62, p. 296-337) gives an extended illustrated account of the life-history of *thrips secalina* and *phloeothrips frumentaria*, which do extensive injury to grain in Russia, and adds notes on *thrips antennata*, *t. rufa*, and *phloeothrips armata*, which also live on grain. Injury is caused to grain in two ways by thrips. First the larvae, in large numbers, pierce the ear before it has made its appearance, to such an extent that they cause the death of the tip of the ear. When the ears have further developed both larvae and full-grown thrips pierce the young seed-buds, causing death to the blossoms, and, consequently, poorly-filled heads.

SWARMING OF APHIDES AT PETERBOROUGH, ENGLAND. — *The entomologist* (Oct. 1885, v. 18, p. 267-268) quotes the following from the *Stamford and Rutland guardian* for 14 August, 1885: — Abundance of aphides at Peterborough. — On Thursday, the central streets of the town were rendered impassible with any amount of comfort, owing to the air being thickly laden with myriads of green flies, in some parts almost resembling a mist. The town air seemed in the long-run to upset them, for they were late in the day to be seen covering the ground to nearly an inch in depth. The Corn Exchange had just been re-painted, and acted as an admirable fly-

catcher, causing some amount of amusement to all except the contractor, who was compelled to pumice-stone their corpses off to make the place presentable.

FUNGI PARASITIC ON INSECTS.—The *Journal of mycology* for March 1886 contains a brief sketch of the life of Lewis David von Schweinitz, based on a sketch read before the Academy of natural sciences of Philadelphia, 12 May 1835, by R. Walter Johnson. Schweinitz was a Pennsylvanian botanist, who was born in 1780 and died in 1834. Amongst other systematic work on cryptogams he published descriptions of the fungi parasitic on insects, his being the first described species of these fungi from America. The same numero of the *Journal* contains the beginning of a "Synopsis of the North American *hypocreaceae*, with descriptions of the species," by J. B. Ellis and B. M. Everhart. This family of fungi includes the genus *Cordyceps*, some of the species of which are parasitic on insects, causing the phenomena known as "vegetating larvae."

INSECTS AS AUTHORS OF EPIDEMICS.—Dr. R. L. Maddox, in a paper read before the Royal microscopical society, details the results of further experiments in feeding insects, especially the common blow-fly, on the comma bacillus. His observations include a large number of microscopical determinations. The results of all his investigations lead him to believe that the comma bacillus from cultures can pass in a living state through the digestive tubes of some insects, and, through this fact, that such insects are likely to become an important means of distributing disease, especially to animals that feed upon them. This is in accordance with the views of Dr. Grossi, that "insects, especially flies, may be considered as veritable authors of epidemics and agents in infectious maladies." — *Sci. american*, 18 Dec., 1886.

MIGRATION OF INSECTS. — A proposition has been made in Celyon for the systematic observation of the singular migration of butterflies in that island. Despite occasional references in the local press, nothing has yet been done towards compiling and editing a scientific and comprehensive record of annual observations. It is proposed, therefore, that volunteers should watch for the migration, and send a post-card bulletin to the editor of records, noticing date, direction of flight, direction of wind, the weather, and the species. For the last purpose, amateur observers are to send one specimen of each species noticed, in order to ensure scientific accuracy. A competent naturalist is stated to have offered to revise, assort, and edit all such notices once or twice a year, and publish a periodical report of progress. The annual summary will appear in the 'Taprobanian magazine.' — *Entomologist*, May 1886, v. 19 p. 140.

ANOTHER NUISANCE. — A copy of *The insect world*, a popular paper published by its editor, Noble M. Eberhart, at Chicago Lawn, Ill., has come to our notice. Like a number of journals purporting to deal popularly with scientific subjects, this one abounds with typographical errors and careless statements, but, as if to atone for other shortcomings, it has departments devoted to geology and mineralogy, ornithology, and archaeology. The journal is a monthly, of inconvenient form (31 X 22 cm.), and fills no want in scientific literature. The following quotation from a paper by the editor, entitled, "Among the insects" will sufficiently show the scientific and literary value of this new entomological journal.

"FORFICULIDAE.—This family contains the Earwigs. Common superstition is that they enter the human ears; but this is absurd, as the excretions of the ear would kill the insect."

How long since was the ear discovered to be an *excretory* organ? *G: D.*

# PSYCHE,

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 143.**

MARCH 1888.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

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Having accumulated an immense stock of references to the literature of entomology, I will furnish references on special subjects at ten cents each reference, or fifty cents per decade. For further particulars see PSYCHE for Oct.-Dec. 1884, v. 4, p. 223.

B: PICKMAN MANN,
Washington, D.C.

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The librarian of the Cambridge Entomologica Club calls attention to the desirability of preserving in the library of the Club as complete a series of entomological publications as it is possible to collect. It is especially desirable to preserve the transient literature of the subject—separates, small pamphlets and newspaper articles—and the librarian will be pleased to receive single copies of the daily papers, scientific journals, magazines, or agricultural papers, which contain entomological articles. These papers are preserved and catalogd, and, because they are overlooked by large general libraries, are just the kind of material that should be preserved in a special entomological library. Any one who has sought for some of the best of the agricultural journals of the western states in libraries will appreciate any effort made to preserve journals of this sort.

Separates which are often thrown into the waste-basket, as useless, as too small for preservation, as duplications of parts of serials, or as valueless, are respectfully solicited. The friends of the Club are also asked to send a copy of newspapers in which they have published articles or notes on entomological subjects. If these notes are anonymous, the author's name will be acceptible information.

The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

Direct all papers for the library to

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# MIMICRY IN HEMIPTERA.

E. P. VAN DUZEE, BUFFALO, N. Y.

The family *lygaeidae* presents us with two examples of protective mimicry that seem well worth recording. These cases which are very similar, have doubtless been frequently observed by collectors, but I have seen no published account of them. I refer to the adolescent stages of *Cymus angustatus* and *Oedancala dorsalis;* both live on the various species of *Carex* and *Juncus* growing in swampy places in open woods and pastures.

*Cymus angustatus* occurs principally on *Juncus nodosus* and allied species, but is frequently found on the smaller *Carices;* it is extremely abundant in the localities mentioned above, and along roadside ditches, and in fact wherever the *Juncus* grows. In this vicinity it appears in May, and continues until late in autumn; copulation takes place about the first of July, the immature insects are abundant through the last of July, the imago appearing from the first to the tenth of August. The young, at least in the nymph state, bear a striking resemblance to the capsules and perigynia of the plants on which they occur; they are of a dull straw-color, ovate in form, compressed or somewhat lenticulate, acute behind, produced and blunt before, and with the connexivum expanded and very thin. When taken in the sweep-net with the glumes and fruit of these plants, it is all but impossible to detect them as long as they remain quiet, which however, fortunately for the collector, is never for any considerable length of time. I have frequently poked them aside with my tweezers, never suspecting their true character until they indicated it by scrambling to their feet and running off, which they did with surprising facility.

*Oedancala dorsalis* is a larger species and rather less abundant; it occurs wherever *Carex vulpinoidea* can be found, but can frequently be taken on other species of *Carex* and *Cyperus*. In the nymph state it greatly resembles the preceeding, but is larger, more rounded in form, has a conspicuous dark line on the dorsum, and is of a much more sluggish disposition; it is equally difficult to detect, when on the plant or mixed with the contents of the sweep-net. The imago when senile is

deeply suffused with red; in this state they can be found through June and July, when, however, they are less common than at other times: they reach maturity about the tenth of August, but occur throughout the summer from May to September, being the most abundant in August.

I would here mention another hemipteron that affects the same plants, through July and August, the *Liburnia dorsalis* of Fitch, who described it under the Fabrician genus *Delphax.* Like the foregoing species it derives protection by its close resemblance to the inflorescence of its native grasses, being of a soiled yellow or testaceous color with a darker dorsal stripe. It is not a common species here, and is difficult to capture as it is very shy and agile, and when approached leaps so quickly that the eye cannot follow it. I have never taken the young.

## VARIABLE NUMBER OF MOLTS OF INSECTS.

BY ANNA KATHERINA DIMMOCK, CAMBRIDGE, MASS.

The first notes given below are translated from a paper by Alfred Wailly, entitled "Educations d'attaciens sériçigènes faites à Norbiton, Surrey, Angleterre, en 1884" (Bull. d'insectol. agricole, Nov. 1885, v. 10, p. 173-174).

"In my English article, recently published in the Journal of the Society of arts, of London, I have given certain accounts of the curious system employed by Mr. Weniger in rearing lepidoptera and of the extraordinary results obtained by him. He rears the larvae in a large glass box, a green-house in miniature, heated by a kerosene lamp, upon which is placed a saucer filled with water. The larvae, kept at a uniform temperature of about 25 degrees centigrade, live in an atmosphere charged with the vapors of water and kerosene, and instead of dying of disease, they develop with extraordinary rapidity. I have seen the larvae of *Antheraea mylitta*, hatched seven days after the deposition of the eggs, arriving at their last stage towards the end of a month. *Attacus atlas* was reared in a like manner, and fourteen days after the formation of the cocoons, the emergence of the moths took place; but not a single copulation was obtained. Many delicate species difficult to rear, have been reared in this manner with great success.

"There is also a fact which, I think, here merits attention. The larvae of *Antheraea mylitta* and of *Ceratocampa imperialis*, species considered as having six stages, and which, when reared under normal conditions actually have the six stages, when reared in this

warm, moist atmosphere have but five stages; Mr. Weniger tells me that there was no error on his part as to the number of stages; none were overlooked.

"My correspondent in Ceylon, who has for many years reared *Antheraea mylitta*, likewise asserts in an article published by him in a journal at Colombo, and which I have lately read, that the *mylitta* race which he reared had but five stages; in Ceylon too the climate is warm and moist.

"*Platysamia cecropia* has also six stages, but cannot this likewise have but five, reared under these same conditions? May we not conclude from these facts that certain species of lepidoptera can have many or fewer stages according to the conditions or according to the way in which they are reared? Further observations will be made on this subject which I shall submit to the society."

In connection with this article by Mr. Wailly, it may be well to mention a few more observations on this interesting subject. Dr. C. V. Riley (1st ann. rept. state entom. Mo., 1869, p. 145), observed that the larvae of *Orgyia leucostigma* which produced females had four molts, while those producing males had but three. Mr. J. Hellins (Entom. month. mag., 1881, v. 18, p. 86) noticed, apparently, no sexual difference as regards the number of molts of *Orgyia antiqua*, having reared four larvae which molted as follows: one male molting three, another one four times; one female molting four, another one five times. This is at variance with Dr. Riley's statements above noted. Yet another observer, Mr. N. Coleman (Papilio, 1882, v. 2, p. 165), noticed the fact that a certain larva of *Orgyia leucostigma*, bred at the same time, and under the same conditions as others of its species, molted once more than did any of the others, and that this individual, upon emergence from the cocoon, proved to be a female. The variability of the number of molts of *Orgyia leucostigma* is evidently for the purpose of enabling the female to attain its full size, which is, in that genus, considerably larger than that of the male, but there is possibly a variation in the number of molts that is due to climatic influences, corresponding, therefore, in a way, to the results obtained by Mr. Weniger.

Dr. C. V. Riley disagrees with Mr. Wailly as to the number of molts of *Attacus cecropia*, the former (Amer. entom., Feb., 1870, v. 2, p. 100) recording but five, the latter (Bull. Soc. acclim. France, May 1882, s. 3, v. 9, p. 266-267) six stages. Might not this be due to climatic influences? Mr. W: H: Edwards stated (Psyche, 1881, v. 3, p. 171) that he found upon rearing *Callosamia promethea* that the larvae molted but three times, while Mr. Lintner (Entom. contributions, no. 3, 1874, p. 126) believes the larva of this species to have four molts. As Mr. Edwards' specimens were reared farther south than were Mr. Lintner's, it would appear that this instance, if due to climatic influence, was as would be expected, i. e., that the larvae reared at the north had more molts than those reared at the south.

# PSYCHE.

CAMBRIDGE, MASS., MARCH 1888.

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## CURIOUS PUPA OF PIERIS.

Some time ago I found a pupa-skin of *Pieris rapae* in the cell of a deserted nest of the common paper-wasp (*Polistes*). It was fastened into the cell by the end, in the usual way, but I cannot be certain about the girdle; if there was any I failed to see it. This is the only instance in which I know of this species seeking such a place of concealment.

*C: W: Woodworth.*

## PARASITES STINGING PUPAE OF PIERIS RAPAE.

In looking over the *American entomologist* for 1880, I came upon the following statement, on page 126,—

"CABBAGE-WORM PARASITE.—We notice that correspondents of the agricultural and horticultural press when referring to the *Pteromalus puparum*, or imported cabbage-worm parasite, generally state that the female fly deposits her eggs in the pupa or chrysalis. This, however, is incorrect, as any one can discover by gathering some of the infested full-grown caterpillars and placing them in a close box to undergo their transformation."

Unless the "Imported cabbage-worm" has more than one parasite this is an incorrect correction! In the summer of 1883 great numbers of *Pieris rapae* laid their eggs on nasturtium (*Tropaeolum*) leaves by the side of our house. I watched the young larvae through all their changes, noted the great number of tiny parasitic flies, and watched the egg-laying of the latter. Many laid their eggs in half-grown or fully grown larvae. Many also punctured larvae which had suspended for pupation, and as many laid their eggs in the very fresh pupae, stinging them usually between the abdominal segments. I saw no parasite sting a pupa which was more than an hour old, but that may have been because it had been stung either as fresh pupa or larva.

Out of forty pupae which I watched, and took down after they were a day old, I got not one imago of *Pieris rapae*, but plenty of small flies. I am not sure of the name of these flies, for I was not interested in the parasites then, and took no pains to identify them.

That pupae are never stung by parasites does not seem to be proved by the fact that parasites will emerge from "infested full-grown caterpillars" which are taken and put in a close box to undergo their transformation." Like so many disputed questions both side are true, I did not know there was any question about it until, in looking for something else, I came upon this statement.

*Caroline G. Soule.*

## EGG-LAYING OF LIMENITIS DISIPPUS.

Miss Soule's note (PSYCHE v. 5, p. 14), interested me very much. Riley records an instance of three eggs laid on a single leaf, but I have never seen so extreme a case, and with hardly an exception have found the eggs laid singly. Is Miss Soule confident that the several eggs on a given leaf were all laid by the same butterfly? Was there any disparity in the time of their hatching? It would be interesting to know what difference there might be. In one instance where I saw two eggs laid within five minutes of each other, one hatched from eighteen to twenty hours after the other.

*Samuel H. Scudder.*

## BIBLIOGRAPHICAL RECORD.

*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name, as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic; G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

**Bergé**, Albert. De la coloration des téguments chez les insectes et spécialement chez les coléoptères. 2e note. (Compte-rendu Soc. entom. Belg., 3 Oct. 1885, p. 113–115.)

Separate. 3 p., 25 × 16, t 19 × 10.5.

Correction by the author. (*op. cit.*, 7 Nov. 1885, p. 125.)

Rev. of H. A. Hagen's "On the color and the pattern of insects" (Proc. Amer. acad. arts and sciences, 1882, v. 17, p. 234–267), with further remarks on the coloration of insects, in continuation of the author's "Note sur la coloration des téguments chez les insectes" . . . [Rec. 4419.] *G: D.* (4418)

**Bergé**, Albert. Note sur la coloration des téguments chez les insectes et spécialement chez les coléoptères. (Compte-rendu Soc. entom. Belg., 5 Sept. 1885, p. 100–102.)

Separate. 3 p., 25 × 16, t 19 × 10.5.

Considers the part taken by the different modes of coloration—pigment, etc.—in the resultant coloration of coleoptera, and the changes which these colors undergo when treated with chemicals. *G: D.* (4419)

**Bergé**, Albert. Des variétés du *carabus auronitens* Fab., au point de vue de la coloration. (Compte-rendu Soc. entom. Belg., 7 Nov. 1885, p. 126–129.)

Separate. 4 p., 25 × 16, t 19 × 10.5.

The author has succeeded by chemical means in producing all the numerous color-varieties of *carabus auronitens*, and groups these varieties according to their changes of coloration. *G: D.* (4420)

**Brauer**, Friedrich. Offenes schreiben als antwort auf Herrn Baron Osten-Sacken's "Critical review" meiner arbeit über die notacanthen. Wien *author*, 1883. t.p. cover, 11 p., 23×14.5, t 16.5×10.5.

Answer to C: R. Osten Sacken's "On Professor Brauer's paper: Versuch einer characteristik der gattungen der notacanthen. 1882" (Berl. entom. zeitschr., 1882, v. 26, p. 363-380) [Rec., 4447]. *G: D.* (4421)

**Brauer**, Friedrich. Die zweiflügler des kaiserlichen museums zu Wien. **2**. (Denksschr. d. Math.-naturw. cl. d. Kais. akad. d. wissensch., 1882, v. 44, p. 59-110, 2 pl.)

Rev. (Bertkau, P. Bericht . . . der entom. f. 1881, 1882, p. 146-147, 154-155.)

Notice, by F. A. F. Karsch. (Zool. jahresb. für 1882, 1883, abth. 2, p. 337, 344, 350-351, 355-361, 363, 365, 380.)

Contains three sub-chapters as follows:—

1. Versuch einer characteristik der gattungen der notacanthen Ltr., mit rücksicht auf die im kaiserlichen museum befindlichen von Dr. J. R. Schiner aufgestellten neuen gattungen.

Crit. rev., by C: R. Osten Sacken, entitled, "On Professor Brauer's paper: Versuch einer characteristik der gattungen der notacanthen. 1882." (Berl. entom. zeitschr., 1882, v. 26, p. 363-380.)

Characters and relationships of, and table for the generic determination of *notacantha*; description of new or hitherto insufficiently described genera and species, according to Schiner's catalog; includes *myxosargus fasciatus*, n. g. et n. s., from Mexico; résumé of the genera according to the chief groups.

2. Vergleichende untersuchungen des flügelgeäders der dipteren nach Adolph's theorie.

Comparison of the venation of the wings in different families of diptera, according to Adolph's method, including a table comparing the terminology of veins as used by Hagen, by Meigen and by Schiner. The two plates illustrate venation of the wings of diptera.

3. Characteristik der mit *scenopinus* verwandten dipteren-familien.

Consideration of the position of *scenopinus*, which the author puts with *pseudatrichia* in a group, *scenopinidae*. *G: D.* (4422)

**Chambers**, Vactor Tousey. New species of *tineina*. (Journ. Cincinnati soc. nat. hist., Jan. 1881, v. 3, p. 289-296.)

Separate. [Cincinnati, 1880. t.-p. cover + 8 p., 23 × 15.5, t 16.5 × 10.5. il.

Describes 10 new species of *tineina*, belonging to the genera *gelechia*, *glyphypteryx*, *douglassia*, *laverna*, *elachista*, *gracilaria*, and *opostega*. *G: D.* (4423)

**Dewey**, James T. Lepidoptera attracted by electric light. (Entomologist, Jan. 1882, v. 15, p. 21-22.)

List of lepidoptera captured about an electric light. *G: D.* (4424)

**Elwes**, H: J: Additional notes on the genus *colias*. (Trans. Entom. soc. Lond., 1884, p. 1-26.)

List of the species of *colias*, divided into groups, and with notes on habitat of each species; discussion of the specific characters in the genus, and of the synonymy of several species, including some from North America. *G: D.* (4425)

**Emery**, Carl. Fortbewegung von tieren an senkrechten und überhängenden glatten flächen. (Biol. centralbl., 15 Sept. 1884, v. 4, p. 438-443.)

A general review of the views held by Dahl, Dewitz, Rombouts, and Simmermacher, as to how insects are able to walk on vertical or overhanging smooth surfaces. *G: D.* (4426)

**Engelmann**, G: Notes on the genus *yucca*. No. 2. (Trans. Acad. sci. St. Louis, 25 Apr. 1874, v. 3, p. 210-214.)

Corrections and additions to author's "Notes on the genus *yucca*" (*op. cit.*, 15 Apr.-27 June 1873, p. 17-54) [Rec., 2641]; includes statement that *tegeticula yuccasella* oviposits in all the species of *sarcoyucca* as well as in all yuccas with dry pods; place and manner of deposition of eggs of the *tegeticula*; effect of this deposition upon the ovules of the plant. *B: P. M.* (4427)

**Faxon**, Walter. On the presence of *demodex folliculorum* in the skin of the ox. (Bull. Mus. comp. zool., 1878, v. 5, no. 2, p. 11-16, 1 pl. + 1 p. expl.)

Separate. Cambridge, Mass., May 1878. t.-p. cover, p. 11-16, 1 pl. + 1 p. expl., 25 × 15, t 17 × 10.

Account of the damage done to leather from the ox (*bos*) by the presence in its skin of *demodex folliculorum;* description of this parasite; its external anatomy; history and literature of *d. folliculorum*, and quotation of the treatment recommended by J. B. Simonds for dogs afflicted with these parasites. *G: D.* (4428)

**Liénard**, Valère. Recherches sur le système nerveux des arthropodes. Constitution de l'anneau œsophagien. (Arch. de biol., 1880, v. 1, p. 380-391, pl. 15.) [Rec. 1747.]

Notice. (Amer. nat., Nov. 1880, v. 14, p. 812.)

Researches on the commissure which connects the two portions of the infraoesophageal ganglion transversely in the arthropoda. *G: D.* (4429)

**Lowne**, B: Thompson. On the so-called suckers of *dytiscus* and the pulvilli of insects. (Monthly micros. journ., June 1871, v. 5, p. 267-271, pl. 89.)

Considers that *dytiscus* attaches itself with its anterior tarsi by virtue of a secretion from the tarsi, and not because it produces a partial vacuum with the disks of its tarsi; compares this mode of attachment with the like mode of adhesion in other beetles and in flies, where the tarsi are provided with glands which open into the tubular hairs of the pulvilli; figures the anterior foot of *dytiscus marginalis* and its so-called suckers. *G: D.* (4430)

**Lucas**, [Pierre] Hippolyte. [Note sur le *gibbium scotias*]. (Ann. Soc. entom. France, 1884, s. 6, v. 4; Bull., p. 77-78.)

Note on the breeding of *gibbium scotias* in a box of ground red-pepper (fruit of *capsicum annuum*). *G: D.* (4431)

**Ludwig**, Friedrich. Ueber das verschwinden gewisser insekten infolge der einwanderung der *puccinia malvacearum* Mont. (Hedwigia, Sept.-Oct. 1885, v. 24, p. 219-220.)

Abstract, by W. A. Kellerman. (Journ. of mycology, Jan. 1886, v. 2, p. 9-10.)

*Puccinia malvacearum* has caused the extinction of certain species of *malvaceae* in regions where it has been introduced, and consequently has exterminated or caused a change of food-habits of species of insects which feed upon these plants; in a part of South Australia this fungus has nearly caused the extinction of *lavatera plebeja*, and with its disappearance also disappeared the beautiful beetles of the genus *lamprima* that visited the flowers of the latter in myriads. *G: D.* (4432)

**McCook**, H: Christopher. The honey ants of the Garden of the gods [Colorado]. (Proc. Acad. nat. sci. Philad., 1881, p. 17-77, pl. 1-10.)

Abstract, by R. Vion, entitled, "Les fourmis à miel." (Bull. Soc. linn. du nord de la France, 1882, v. 6, p. 87-90.)

The subjects pertaining to the honey-ant (*myrmecocystus melliger*), of which this paper treats, may be enumerated by quoting, with some alterations, the author's headings, as follows: 1, geographical distribution; 2, nest-sites and exterior architecture of the nests; 3, position of the honey-bearers in the nest; 4, nectar-producing galls the source of the honey-supply, nocturnal habits; 5, quality of the ant-honey, its chemical composition and its uses as food and medicine; 6, interior architecture of the nest, gates, galleries and rooms of different kinds, floors and roof; 7, queen-life, her body-guard, depositing eggs; 8, acts of beneficence, lack of individual beneficence, cleansing and feeding larvae, toilet habits, fraternal relations with sister colonies; 9, economy of the honey-bearers, which are used as storehouses of honey, and which regurgitate the honey for the use of the workers, treatment of dead honey-bearers, effects of withholding food, mode of covering obnoxious matter, food-habits; 10, anatomy of the alimentary canal, the segmental plates of the abdomen and their arrangement to permit distention of the abdomen, the crop or ingluvies, the gizzard or proventriculus, the stomach, malpighian tubes, the intestine, notes on the Australian honey-ant (*camponotus inflatus*); 11, possible organs of stridulation in ants and the sounds which ants produce; 12, destruction of the ants by mites; 13, previous accounts of the honey-ant; 14, description of the species. The plates contain numerous illustrations of the subjects mentioned above. *G: D.* (4433)

**McIntire**, S. J. An incident in the life of a chelifer. (Monthly micros. journ., Nov., 1871, v. 6, p. 209-210, pl. 102, fig. 3.)

Gives notes on the breeding habits of *chelifer*, and figures a female bearing the egg-case; the food of *chelifer* is incidentally mentioned to be podurans. *G: D.* (4434)

**Müller**, Fritz. Eine aufgabe für lepidopterologen. (Berl. entom. zeitschr., 1883, v. 27, p. 214-216.)

Separate. [Berl., 1883.] p. 214-216, 22 × 14.5, t 16.5 × 10.

Discusses the bearing of similar characters, and similar food-plants of larvae, on the systematic relationship of certain lepidoptera. *G: D.* (4435)

**Müller**, Fritz. Sobre as casas construidas pelas larvas de insectos trichopteros da provincia de Santa Catharina [e supplemento]. (Arch. do Museu nacional do Rio de Janeiro, 1878; v. 3, p. 99-134, 210-214, pl. 8-11.)

Abstract, by the author, entitled, "Notes on the cases of some South-Brazilian *trichoptera*." (Trans. Entom. soc. Lond., 1879, p. 131-144.) [Rec., 4441.]

Germ. tr., by Hermann Müller, entitled, "Ueber die von den trichopterenlarven der provinz Santa Catharina verfertigten gehäuse." (Zeitschr. f. wiss. zool,, 1880, v. 35, p. 47-87, pl. 4-5.) [Rec., 2544.]

Abstract, by H. A. Hagen. (Zool. jahresb. für 1880, 1881, abth. 2, p. 218-228.)

Abstract. (Bertkau, Ph. Bericht . . . der entom. f. 1880, 1882, p. 119-120.)

Biological notes on a large number of Brazilian species of *trichoptera*, with descriptions and figures of their larva-cases. *G: D.* (4436)

**Müller**, Fritz. A correlação das flores versicolores e dos insectos pronubos. (Arch. do Museu nacional do Rio de Janeiro, 1877, v. 2, p. 19-23.)

Shows how a species of *lantana* secures more certain fertilization by insects because it has flowers of which the corolla is successively of three different colors; observations upon the insects that visited the flowers when they were of each successive color. *G: D.* (4437)

**Müller**, Fritz. On female dimorphism of *paltostoma torrentium*. (Entom. mo. mag. Mch. 1881, v. 17, p. 225-226.)

Reply to C: R. Osten Sacken's "Dr. F. Müller's discovery of a case of female dimorphism among diptera" (Entom. mo. mag., Nov. 1880, v. 17, p. 130-132) [Rec., 3519]; argues that the forms of *paltostoma torrentium* described belong to one species; remarks on other criticisms. *B: P. M.* (4438)

**Müller**, Fritz. As maculas sexuaes dos individuos masculinos das especies *danais erippus* e *d. gilippus*. (Arch. do Museu nacional do Rio de Janeiro, 1877, v. 2, p. 25-29, pl. 2.)

Describes and figures the structure of the sexual spots on the hind wings of the male of *danais archippus*, and the tufts which the same insect can protrude from near the posterior end of its abdomen. *G: D.* (4439)

**Müller**, Fritz. A metamorphose de um insecto diptero. (Arch. do Museu nacional do Rio de Janeiro, 1879, 1881, v. 4, p. 47-85, pl. 4-7.)

Describes and figures the external and internal anatomy of the different stages of *paltostoma torrentium*, a dipteron of the family *blepharoceridae;* the species exhibits a remarkable dimorphism in the female, especially marked in the structure of the mouth-parts of the imago; the larva has six suckers along the median line of its ventral surface, and uses them to fasten itself to the stones in the streams where it lives. *G: D.* (4440)

**Müller**, Fritz. Notes on the cases of some South Brazillian *trichoptera*. (Trans. Entom. soc. Lond., 1879, p. 131-144.)

Notice. (Amer. nat., Sept. 1880, v. 14, p. 665.)

Numerous notes on the biology of South American *trichoptera*, and the structure of their cases. The full descriptions and figures of the cases mentioned in this paper are published in the author's "Sobre as casas construidas pelas larvas de insectos trichopteros da provincia de Santa Catharina". . . (Arch. do Museu nacional do Rio de Janeiro, 1878, v. 3, p. 99-134, 210-214, pl. 8-11) [Rec., 4436]. *G: D.* (4441)

**Müller**, Fritz. Os orgãos odoriferos da *antirrhaea archaea* Hübner. (Arch. do Museu nacional do Rio de Janeiro, 1878; v. 3, p. 1-7, pl. 1.)

Describes the odoriferous spots, and the scales which form them, on the wings of *antirrhaea archaea*. *G: D.* (4442)

**Müller**, Fritz. Os orgãos odoriferos das especies *epicalia acontius*, Lin. e de *myscelia orsis*, Dru. (Arch. do Museu nacional do Rio de Janeiro, 1877, v. 2, p. 31-35, pl. 3.)

Describes the odoriferous spots (filzflecke) on the wings of males of *epicalia acontius* and of *myscelia orsis;* figures the wings, and modified scales from them. *G: D.* (4443)

**Müller**, Fritz. *Paltostoma torrentium*. Eine mücke mit zwiegestaltigen weibchen. (Kosmos, Oct. 1880, v. 8, p. 37-42, il.)

Crit. rev., by C: R. Osten Sacken, entitled "Dr. F. Müller's discovery of a case of female dimorphism among diptera." (Entom, mo. mag., Nov. 1880, v. 17, p. 130-132.) [Rec. 3519.]

Abstract, by P. Mayer. (Zool. jahresb. für 1880, 1881, abth. 2, p. 119.) Abstract, by F. Karsch. (*op. cit.*, p. 249-250.)

Notice. (Bertkau, Ph. Bericht . . . der entom., f. 1880, 1882, p. 128.)

Describes and figures the head, mouth-parts, and claws of the two forms of the female of *paltostoma torrentium*, a Brazilian species of *blepharoceridae* exhibiting remarkable dimorphism in that sex, especially in the parts above mentioned. *G: D.* (4444)

**Müller**, Fritz. A prega costal das hesperideas. (Arch. do Museu nacional do Rio de Janeiro, 1878, v. 3, p. 41-50, pl. 5-6.)

Describes the sexual spots on the costae of the anterior wings of certain *hesperidae*, and the scales which are contained in these spots; these costal spots, which are probably odoriferous organs, are described and figured in *telegonus midas, t. mercatus, hesperia syrichtus, leucochitonea arsalte, thymele simplicius, t. protillus, t. proteus* and *entheus vitreus*. *G: D.* (4445)

**Osten Sacken,** C: Robert. Bemerkungen über blepharoceriden. Ein nachtrag zur "Revision" dieser familie von Professor Dr. Loew. (Deutsche entom. zeitschr., 1878, v. 22, p. 405-416.)

Notes on the form and size of the eyes of the *blepharoceridae* and the arrangement of the facets upon them; geographical distribution of the species; critical notes on Francis Walker's work on diptera; gives an extended description of *liponeura* (*blepharocera*) *yosemite* from Cal., and compares it with other species; synopsis of the genera of *blepharoceridae;* characters in which the genera agree and differ, arranged according to the organs. [Corrigendum, by author: On p. 406, line 11 from top, after "Hinsicht," insert "ausserhalb der Familie der Cyrtiden."] G: D. (4446)

**Osten Sacken,** C: On Professor Brauer's paper: Versuch einer characteristik der gattungen der notacanthen. 1882." (Berl. entom. zeitschr., 1882, v. 26, p. 363-380.)

Reply, by F. Brauer, entitled "Offenes schreiben als antwort auf Herrn Baron Osten-Sacken's 'critical review' meiner arbeit über die notacanthen. Wien. 1883. t.-p. cover, 11 p., 23×14.5, t 16.5×10.5.

Detailed critical review of F. Brauer's "Versuch einer characteristic [etc.]" in author's "Die zweiflügler des Kaiserlichen museums zu Wien. 2" (Denkschr. d. Kais. akad. d. wissench., Math-naturw. cl., 1882, v. 44, p. 59-110) [Rec., 4422], with numerous additions and notes. G: D. (4447)

**Plateau,** Félix [Auguste Joseph]. Une expérience sur la fonction des antennes chez la blatte, *periplaneta orientalis.* (Compte-rend. Soc. entom. Belg., 5 June 1886. p. 118-122.)

Separate. Gand, 1886, 5 p., 24 × 16, t 19 × 10.5.

Notice. (Entom. nachrichten, Dec. 1886, v. 12, p. 365.)

Critical review of V. Graber's "Vergleichende grundversuche über die wirkung und die aufnahmestellen chemischer reize bei den tieren." (Biol. centralblatt, 1 Sept. 1885, v. 5, p. 385-398) [Rec., 4408], in which Plateau comes to the conclusion that the antennae are the sole olfactory organs in *blatta orientalis*, contrary to Graber's view that the cerci of these insects are able to perceive odors. G: D. (4448)

**Radoszkowski** Octav Ivan. Revision des armures copulatrices des mâles de la famille de mutillides. (Horae Soc. entom. ross., 1885, v. 19, p. 3-49, pl. 1-11.)

Regards the form of the genitalia of the males of *mutillidae* as often indispensable in separating the species; figures and describes the male genitalia of many species of the family, after having rendered these parts transparent by soaking them in a solution of caustic potash [KOH]; general structure and nomenclature of the parts of the male genitalia, in which the part termed *squama* in *bombus* is given the name *tenaculum;* characterizes the genera, adding 3 new genera; *dasylabris*, *edrionotus*, and *tricholabioides.* G: D. (4449)

**Rey,** Claudius. Comparaison entre plusieurs larves de divers genres d'élatérides. (Ann. Soc. linn. de Lyon, 1883, 1884, n. s., v. 30, p. 443-446.)

Classification of the larvae of the *elateridae* by use of the structure of the last abdominal segment. G: D. (4450)

**Rey,** Claudius. Description de la larve de l'*anthicus floralis* Linné. (Ann. Soc. linn. de Lyon, 1882, 1883, n. s., v. 29, p. 141-142.)

Describes the larva of *anthicus floralis* in detail. G: D. (4451)

**Rey,** Claudius. Quelques exemples de monstruosités chez les coléoptères et hémiptères. (Ann. Soc. linn. de Lyon, 1883, 1884, n. s., v. 30, p. 423-424.)

Brief notes on eight deformed coleoptera and on two hemiptera. G: D. (4452)

**Roüast,** Georges. Catalogue des chenilles européennes connues. (Ann. Soc. linn. de Lyon, 1882, 1883, n. s., v. 29. p. 251-363; 1883, 1884, v. 30, p. 70-152.)

Catalog of the known larvae of European lepidoptera, with their food-plants or food-habits and the time of their appearance; prefaced to this list, which includes some species found in America, is a list of the works consulted in its compilation. G: D. (4453)

**Rudow,** Ferd. Beobachtungen über die lebensweise und den bau der mallophagen oder pelzfresser, sowie beschreibung neuer arten. (Zeitschr. f. d. gesammt. naturwissensch., 1870, v. 35, p. 272-302; 1870, v. 36, p. 121-143.)

Rev. (Brauer, F. Bericht . . . der entom. f. 1870, 1873, p. 118-119.)

Literature of *mallŏphaga;* notes upon their systematic position, habits, external and internal structure, and hosts; the structure of the mouth-parts, and their value in classification; classification of the genera of the *mallophaga*, and descriptions of new species belonging to the genera *lipeurus*, *metopeuron* (n. g.), *ornithobius*, and *trichodectes.* This paper is a continuation of the author's "Neue mallophagen" (*op. cit.*, 1869, v. 34, p. 387-407) [Rec., 4457]. G: D. (4454)

**Rudow,** Ferd. Neue mallophagen. (Zeitschr. f. d. gesammt. naturwissensch., 1869, v. 34, p. 387-407.)

Rev. (Brauer, F. Bericht . . . der entom. f. 1869, 1871, p. 167, 175-176.)

Describes new species of *mallophaga* from the Hamburg museum, belonging to the genera *colpocephalum*, *menopon*, *laemobothrium*, and *trinoton*, of the family *liotheidae.* This paper is continued in the author's "Beobachtungen über die lebensweise und den bau der mallophagen" . . . (*op. cit.*, 1870, v. 35, p. 272-302) [Rec., 4456]. G: D. (4455)

## ENTOMOLOGICAL ITEMS.

ODOROUS BUTTERFLIES. — The butterflies of India seem to be often odorous. In a "List of the lepidopterous insects collected in Cachar by Mr. Wood-Mason, part 2, Rhopalocera," by Messrs. J. Wood-Mason and L. de Nicéville (Journ. Asiatic society of Bengal, 1886, v. 55, pt. 2, no. 4, p. 343-393, pl. 15-18), among the 249 species found in that district, twelve species are mentioned as odorous. Five species of *nymphalidae* are described as having vanilla-scented males. Of *Stichophthalma camadeva*, Mr. Wood-Mason writes, "The gland covered by a patch of modified scales and by an erectile wisp of hairs on each hind wing in the male, secretes a fluid that gives out a pleasant odor distinct from, but so faint as barely to be perceptible in the presence of a much stronger odor (resembling that of sable fresh from the furrier's shop) which is common to the two sexes." Of the male of *Catopsilia gnoma* it is said that the tufts of hair on the wings smell like jessamin. Three species of *papilionidae* are mentioned as having a musky odor. *Papilio dasarada* is described as having "a strong scent of caged porcupines with a touch of musk." In *P. aristolochiae* "the male emits a strong and slightly pungent odor resembling that of ? batchelor's buttons or of the rose with a trace of acetic acid." G: D.

NECROLOGY. — Since our last necrological notice (PSYCHE, Jan.–Mar. 1885, v. 4, p. 266), news has been received of the death of the following entomologists, or persons who have contributed to entomological literature: Spencer Fullerton Baird, secretary of the Smithsonian institution, at Washington, D. C., zoologist, b. 3 Feb. 1823, in Reading, Pa., d. 19 Aug. 1887, at Woods Holl, Mass. Heinrich Anton de Bary, cryptogamic botanist, b. at Frankfort-on-the-Main, Germany, 26 Jan. 1831, d. 19 Jan. 1886, at Strassburg, Germany. Dr. Edward Becher, entomologist and assistant in the royal museum in Vienna, Austria, d. in that city, 11 Nov. 1886. Thomas Bland, entomologist and conchologist, b. 4 Oct. 1809, in Nottinghamshire, Engl., d. 20 Aug. 1885, in Brooklyn, N. Y. Henri Brisout de Barneville, entomologist, d. 23 Jan. 1887, in Saint-Germain-en-Laye, France. Dr. Adam Todd Bruce, anatomist and embryologist, instructor in Johns Hopkins University, d. in Cairo, Egypt, 11 Feb. 1887. Nicholas Cooke, lepidopterist, b. 14 Jan. 1818, at Liverpool, d. 19 May 1885, at Leatherhead, England. Thomas Cooke, London entomologist, b. in 1814, d. 10 June 1885. Carl Cornelius, teacher in the Realschule in Elberfeld, from 1833 to 1874, who has contributed largely to the literature of the biology of insects, b. 17 Nov. 1805, in Soest, Germany, d. 1 April 1885, in Elberfeld, Germany. Thomas Edward, whose life is told by S: Smiles in his "Life of a Scotch naturalist," b. 25 Dec. 1814, in Gosport, d. 27 April 1886. James English, entomological collector, d. 12 Jan. 1888, in Epping, England, aged 67 years. William Farren, entomological collector, d. at Cambridge, Engl., 21 Nov. 1887, aged 51 years. John Firth, lepidopterist and ornithologist, d. in Bradford, Engl., 29 Aug. 1885, aged 53. Dr. Heinrich Leopold Fischer, professor of minerology but well known as a writer on orthoptera, d. in Freiburg, i. Br., Germany, 1 Feb. 1886. Herrmann Friedrich Rudolf Heinrich Gadamer, forester, entomologist and ornithologist, b. 2 May, 1818, in Silesia, d. at Raslätt, near Jönköping, Sweden, 24 April 1885. Dr. Max Gemminger, coleopterist, b. 23 Jan. 1820 [? 20 Jan. 1822] in München, Germany, d. 18 Apr. 1887, in the same city. Maurice Girard, a well-known Parisian entomologist, d. in Aug. 1886, aged 64, at Lion-sur-mer, France, during his summer vacation. Gustav Haller, entomologist, student of *acarina*, d. 1 May 1886, in Bern, Switzerland. James Hamer, entomological collector, d. at Southport, Lancashire, Engl., 14 Nov. 1887, aged 46 years. Oscar Harger, zoologist and pa-

leontologist, b. 12 Jan. 1843, in Oxford, Conn., d. 6 Nov. 1887, in New Haven, Conn. Baron Edgar von Harold, coleopterist, d. 1 Aug. 1886, in Possenhofen, near München, Germany. Rev. John Hellins, lepidopterist, d. in Exeter, Engl., 9 May 1887, aged 58. C. W. Hering, lepidopterist, d. in Stettin, Germany, 1 Feb. 1887, aged 85. Franz Höllmer, lepidopterist, b. 29 Sept. 1820, in Borgholzhausen Kreis Halle, Westphalia, Germany, d. 11 April 1885, in Münster, Westphalia. Johann von Hornig, lepidopterist, d. 29 Nov. 1886, in Vienna, Austria. Nicholas Joly, professor in Toulouse, d. there 17 Oct. 1885, Dr. Wilhelm Kaiser, zoologist, b. 1 Feb. 1841, in Arnsberg, Germany, d. 2 Sept. 1884, in Elberfeld. Frederick W. Klages, collector of insects, d. in Pittsburgh, Pa., 27 March 1886, in his 27th year. Albert Kothe, lepidopterist, b. in 1828, in Berlin, Germany, d. 12 Oct. 1885, in that city. Antonio de Lacerda, entomologist, d. in Bahia, Brazil, early in Aug. 1885, at the age of 51. Charles Lambin, coleopterist, d. at Paris, France, 8 Oct. 1885, at the age of 63 years. Jules Lichtenstein, entomologist, d. at Montpellier, France, 30 Nov. 1886, at the age of 68. Valère Liénard, anatomist and entomologist in Ghent, Belgium, b. in 1856, d. 20 Aug. 1886, in Brussels. Robert Francis Logan, lepidopterist, d. in Spylaw, Colinton, near Edinburgh, Scotland, 28 July 1887. Charles Martin, entomological collector and lieutenant of infantry in the French expedition to Tonquin. Philipp Leopold Martin, taxidermist and museologist, d. 8 Mar. 1885 in Stuttgart. Ferencz [ = François] Metelka, entomologist and pharmacist, b. 21 July 1814, at Hatvan, Hungary, d. 9 March 1885, at Alsó-Dabas, Hungary. Pierre Millière, entomologist, writer on the biology of lepidoptera, d. at Cannes, France, 29 May 1887, aged 74. Dr. Henri Milne-Edwards, eminent zoologist and dean of the scientific faculty at Paris, b. 23 Oct. 1800, in Bruges, France (now Belgium), d. 29 July 1885, in Paris, France. Max Mützell, lepidopterist, d. 16 April 1887, in Berlin, Germany. Karl Plötz, lepidopterist, d. in Greifswald, Germany, 12 Aug. 1886, aged 73. Dr. François P. L. Pollen, zoologist and explorer of Madagascar, b. 7 Jan. 1842, in Rotterdam, Holland, d. 7 May 1886, in Leiden, Holland. John Arthur Power, M. D., coleopterist, b. 18 March 1810, d. in Bedford, Engl., 9 June 1886. Charles Phillippe Robin, French senator, physiologist and entomologist, b. 4. June 1821, at Jasseron, dept. de l'Ain, France, d. 6 Oct. 1885, near Jasseron. John Sang, lepidopterist, d. in Darlington, Engl., 19 March 1887, aged 59. Jörgen Christian Schiödte, entomological writer since 1836, b. 20 April 1815, in Copenhagen, d. 22 April 1884, in the same city. Joseph Sidebotham, astronomer, entomologist and botanist, d. at Bowdon, near Manchester, Engl., 30 May 1885, at the aged of 62. Carl Theodor Ernst von Siebold, distinguished naturalist and since 1853 professor of zoology at München, Germany, b. 16 Feb. 1804, in Würzburg, Germany, d. in München, 7 April 1885. Dr. Georg Simmermacher, a young zoologist, d. 18 May, 1885, in Giessen, Germany, in consequence of accidental poisoning by arseniuretted hydrogen. Gabriel Tappes, entomologist, d. at Batignolles, Paris, 27 Sept. 1885, in his 70th year. Jean Jacques de Tschudi, Swiss traveler and naturalist, d. in St. Gall, Switzerland, 25 Jan. 1886, aged 68. Antonio Villa, naturalist and author of numerous entomological papers, d. 26 June 1885, in Milan, Italy. Adolf Werneburg, forester and lepidopterist, d. 21 Jan. 1887, in Erfurt, Germany. Hendrik Weyenbergh, professor of zoology in Córdoba, Argentine Republic, entomologist, d. in Harlem, Holland, 25 July 1885, aged 42; he was at the time on a visit to his native country. Thomas Wilson, entomologist, d. in York, Engl. 17 April 1887, aged 51. *G: D.*

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Nos. 141-142 were issued 9 Feb. 1888.

PSYCHE

A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

Vol. 5. No. 144.

April 1888.

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Published by the

CAMBRIDGE ENTOMOLOGICAL CLUB,

Cambridge, Mass., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

*INDEX TO ENTOMOLOGICAL LITERATURE.*

Having accumulated an immense stock of references to the literature of entomology, I will furnish references on special subjects at ten cents each reference, or fifty cents per decade. For further particulars see PSYCHE for Oct.-Dec. 1884, v. 4, p. 223.

B: PICKMAN MANN,
Washington, D. C.

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The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

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# A NEW PARASITE OF THE HESSIAN FLY.

BY STEPHEN ALFRED FORBES, CHAMPAIGN, ILL.

Parasitism of the winter brood of the Hessian fly has been but rarely and doubtfully reported, and so far as I know, has not hitherto been strictly authenticated. An observation recorded by Prof. Herrick in 1841[1], probably referring to the parasite now known as *Platygaster herrickii*, Pack., implies an abundant development of that species in the hibernating generation of the "fly," but this observation was almost certainly incorrect in some respects,—as has been shown by Mr. Howard,[2]—and has not been verified in this particular.

The breeding of unknown parasites from infested wheat in spring was reported by the writer in 1885;[3] but the breeding cage management in this case was not such as to make it certain that these were derived from the Hessian fly. The following instance is, consequently, probably the first to establish clearly the occurrence of this phenomenon.

From a field of wheat sowed after oats and corn in the autumn of 1886, living plants containing numerous puparia of the Hessian fly were sent to me Mar. 15, 1887, by my correspondent Samuel Bartley, Esq., of Edgewood, in southern Illinois. A number of these puparia were enclosed in a dry vial; and from them seven imagos of *Cecidomyia destructor* emerged previous to the 23d of April. This vial was not again examined until Oct. 18, when seven proctotrupid parasites were found in it—all dead. These belonged to the genus *Platygaster*, as limited by Foerster[4] and Thomson,[5] and to a species apparently undescribed.

### *Platygaster hiemalis*, n. s.

General surface smooth, shining black; head opaque, very slightly pubescent, not cuboid, wider than thorax, nearly twice as wide as long. Temples narrow, vertex not margined, but minutely transversely rugulose. Front also transversely corrugated above the antennae, this corrugation merging in a general irregular lineation of the face. Upper half of front regularly convex, lower with a slight vertical carina commencing between the bases of the antennae. Ocelli not elevated, lateral ones equidistant from the eye and the median ocellus.

Thorax short, deep, very convex, not compressed; prothorax minutely transversely lineate at the sides; mesothorax shining, ovate, broadest just before wings, dorsum bare in middle, elsewhere with sparse gray hairs, sides more hairy in front. Parapsidal grooves scarcely visible. Scutellum semi-circular, vaulted, nearly hemispherical, without angle or process,

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[1] Herrick, C: E. A brief preliminary account of the hessian-fly and its parasites. (Amer. journ. sci. and arts, 1841, v. 41, p. 153-158), p. 157.

[2] Howard, L. O. (3d rept. U. S. entom. comm., 1883, p. 219, foot note.)

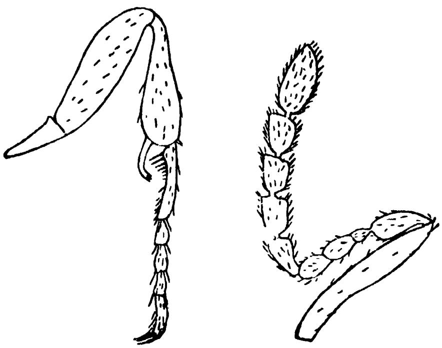
[3] Forbes, S. A. (14th rept. State entom. Ill., p. 46, foot-note.)

[4] Foerster, A. Hymenopterologische studien, heft 2, 1850, p. 108 and 115.

[5] Thomson, C. G. Sveriges proctotruper. (Öfvers. af Kongl. vetensk.-akad. förhandl., 1859, v. 16, p. 69-87) p. 83.

conspicuously hairy in front and at sides, bare and shining in middle; separated from mesoscutum by a rather deep transverse groove with two large coarsely punctate and hairy foveae. Dorsal outline of thorax consequently broken at scutellum. Tegulae shining, smooth, slightly embrowned. Metathorax hairy above and on sides.

Abdomen obovate, not narrowed at tip, smooth, shining, except first segment, which is covered with long gray hairs above and beneath, and the tip of the abdomen, which is slightly hairy at posterior edges of segments. Second segment with elongate basal foveae above, and a longitudinal basal groove on each side beneath, slightly concave to the margin, and extending two-thirds the length of the segment.



Antennae ten-jointed, black, with scape long, sinuous, and not clavate, and reaching to top of head. Club five-jointed in female, six-jointed in male, not compressed, more hairy than scape and funicle. First joint of latter obovate; second small, one-half to one-third the third,—the latter excurved and obliquely truncate in male, similar to fourth in female. First joint of club obconical, remaining joints, except the last, quadrate, nearly equal in length, about two-thirds as wide as long. Last joint in female ovate, obtuse, not much longer than the preceding: in male narrower, acute, nearly twice as long as preceding.

Head, thorax, and abdomen black throughout. Anterior legs yellowish shaded with fuscous, except coxae and distal joint of tarsi, which are black on all the legs. Middle legs darker, hind legs black, except tarsi and band at upper end of tibia. Upper surface of all the femora black. Wings extending far beyond the abdomen, hyaline, iridescent.

Total length of head and body .94 mm.; fore wings .84 mm. long, .35 mm. wide. Head .35 mm. wide, .185 mm. long; thorax .36 mm. long, .29 mm. wide, and .30 mm. deep. Abdomen of female .46 mm. long, .30 mm. wide.

This species differs from *Platygaster herrickii* (authentic specimens of which Mr. L. O. Howard has kindly sent me) chiefly in its much smaller size, more shining aspect,—due to the absence of the reticulate finish of the surface characteristic of *P. herrickii*, —by the shorter and more vaulted thorax, by the corrugated, narrower, and more convex vertex, and the narrower temples,—the head having a less cuboidal form,—but especially in the parapsidal grooves, which in *Platygaster herrickii* are very large and distinct, and in *P. hiemalis* are barely visible in the most favorable light.

From *P. minutus*, very briefly described by Lindeman,[6] it differs in size, and conspicuously so in the proportions of the antennal segments,—Lindeman's species being only .5 mm. in length, and the antennal scape about twice as long as the first joint of the flagellum.

[6] Lindeman, K. Die pteromalinen der hessenfliege, *cecidomyia destructor* Say. (Bull. Soc. impér. natur Moscou, 1887, no. 1, 177-192.) Separate, p. 12.

# NOTES ON *CROESUS LATITARSUS*, NORTON, AND DESCRIPTION OF THE LARVA.

BY JOHN GEORGE JACK, JAMAICA PLAIN, MASS.

In the latter part of August, 1886, I collected a number of sawfly larvae, found feeding upon the foliage of *Betula alba* and *B. papyrifera*, in this vicinity. These larvae were nearly fully grown and during the first week in September they all entered some loose soil and debris and made brownish, oblong cocoons about 12 mm. long, and 6 mm. in diameter. These were kept out of doors in a tin box, all winter, and some of the perfect insects emerged 11 May, 1887.

On 14 June I found larvae in almost all stages of growth, feeding upon birch trees in the Arnold Arboretum and other places in the vicinity of Boston. There were larvae nearly fully grown, while others were just hatched, and portions of the egg-shells remained, arranged along the principal veins of the leaf. About 18 June many of the large larvae entered the soil to pupate, and they emerged as perfect insects 15-20. Aug. Fresh specimens continued to appear from pupae for about two weeks after the last date.

Larvae were found in all stages of growth on 5 September. Most of these had gone to the ground to pupate by 1 October. Very few were found after that date.

The following is a rough description of the mature larva. Head black, shining. Body dull yellowish green, the last two segments being rather lighter than the others and varying to yellowish, especially beneath, and at the extremity of the ventral segment. A broad stripe, free from spots, extends along the dorsal surface, from the head to the anal segment. On each segment, just above the line of spiracles, there is a large, irregular, black spot on each side of the body. On the anal segment, however, they are generally very indistinct. The spots are usually connected together by a cloudy band which is sometimes so dark as to seem almost like an unbroken black stripe. Above the tip of the anal segment there is a large triangular or shield-shaped spot. Below the line of spiracles, and above the legs, there are several black spots, somewhat irregular and confused on the thoracic segments, but becoming more regular and distinct on each succeeding abdominal segment, until, on the last segment with prolegs, they appear as two distinct oblong spots on each side. On the eleventh segment the spots are less distinct and often seem reduced to one, and in the last two segments they are entirely wanting. The ventral surface, between the legs, is usually more or less black. The tibiae, tarsi, claws, and basal portion of the femora of the legs are dark brown on the external side. The prolegs are pale yellowish green and without spots. There are a few very short hairs on the head, along the sides, on the ventral segment around the anus, on the legs, and several on each of the prolegs. Length 20–25 mm.

The young are pale green and the spots are quite pale, but become darker and more distinct as the larvae increase in size. The larvae feed together until

they are about fully grown when they become more scattered. The abdomen is kept slightly raised, but is lifted much more, and the ventral surface exposed, when disturbed. They occurred in sufficient numbers last year to defoliate many young birches and destroy large portions of the foliage of some larger trees. They seemed to devour any species with equal avidity, and these included *Betula alba*, *B. lenta*, *B. lutea*, *B. nigra*, and *B. papyrifera*.

In some respects this larva resembles that of *Croesus septentrionalis* of Europe, but in the latter, the spots are all much more distinct and separate, the upper row are not connected by the brown band, the legs are not so brown, and the prolegs are tipped with brown.

Mrs. A. K. Dimmock in "The insects of Betula in N. A." (Psyche, 1885, v. 4, p. 286) in giving references to this insect says, "Norton (Proc. entom. soc. Phil., 1862, v. 1, p. 199) describes the male of this species and later (Trans. Am. entom. soc., 1867, v. 1, p. 84) describes the female." This is evidently a mistake as both of Norton's descriptions refer to the female.

All the specimens raised by me were females, and there are ten specimens, all females, in the Museum of comparative zoology at Cambridge, Mass., which were collected by J. Shute at Woburn, Mass., in 1870. The only male I have seen is an imperfect one in the Harris collection. In his catalog Harris wrote "Larva on birches, gregarious, Sept., winged May 1, 1827, do. Aug. 5, 1831."

The only references I have seen regarding the larva is at the end of Norton's description of the female (Trans. Am. entom. soc., 1867, v. 1, p. 84) where he says, — "Quite rare, wild cherry, Aug. 16. Bred by Mr. Walsh from larvae feeding on birch." Was the "wild cherry" referred to, the cherry birch, *Betula lenta?*

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## SOUND SLEEP OF LYCAENA AMERICANA.

A few years ago, being detained in Boston until the middle of August, and having few butterflies to study, I was led to notice those few very carefully, especially *L. americana*, which was very abundant in the vacant lots, and the grass-plots in Marlborough street.

I noticed that, as one side of the street grew shady, towards sunset, *L. americana* might be seen clinging to grass-blades, and with wings somewhat drooped, suggesting that the muscles were relaxed by sleep.

Approaching one, I gently touched the grass, but the butterfly remained as before. I shook the grass, then shook it less gently, but the butterfly did not stir. Then I picked the blade, and carried it in my hand, not taking any care to keep it upright, for five blocks, and even then it was only as the sun struck the grass, when I crossed the street, that the butterfly awoke, and lazily flew to a shady place, resting as before. I followed, and this time a touch was enough to startle it. I did not arouse it a third time, but afterwards, in the country, I tried the experiment several times, always with the same result.

I have always found the butterfly in the same position, more than half-way up the grass-blade, in the shade, and with the head up, the wings drooped to an acute, instead of a right, angle with the body. It certainly sleeps very soundly, and when aroused, does not become as active as in the middle of the day.

I have waked and disturbed one *L. americana* six times, each time immediately after it had settled down after a former awakening, and even the last time it flew but ten steps or so, and settled down as before.

*Caroline G. Soule.*

# PSYCHE.

CAMBRIDGE, MASS., APRIL 1888.

*Communications, exchanges and editors' copies should be addressed to* EDITORS OF PSYCHE, *Cambridge, Mass. Communications for publication in* PSYCHE *must be properly authenticated, and no anonymous articles will be published.*

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## GONIA SENILIS WILLISTON.

I had the good fortune to find two specimens of this pretty species of *tachinidae* in the Löw collection from Texas.

The species was described in the number of the *Canadian entomologist* for January 1887 from a single specimen from western Kansas. The specimens that I examined agree with the description in all respects except in the coloration of the abdomen. In one of them the abdomen was wholly black, with the ordinary pilose bands along the edge of each segment, appearing very much like that of *Gonia frontosa* Say. The other specimen on the contrary, had a large amount of red on the abdomen, reminding one of the abdomen of *Gonia exul* Williston, there being only a median line black in the first, second and third segments, and even a trace of red on the base of the fourth. The only other difference observable between these two specimens was the slightly smaller size, shorter wings and less number of black hairs on the base of the antennae, in the second specimen.

There can be no doubt, I think, that these specimens are *Gonia senilis* Williston, because of the agreement in all characters except the color of the abdomen; and, besides, this character is variable in the other species of this genus, but never as far as I know, to anywhere near the extent that it is in this species.

*C: W: Woodworth.*

## THREE RARE ENTOMOLOGICAL WORKS.

The library of the Museum of comparative zoology at Harvard university has lately obtained the following rare works.

The author's original copy of Townend Glover's "Engraved plates of his Illustrations of North American entomology, colored by the hand of the author; also a few original drawings." These are in five quarto volumes.

By the same author, "Original drawings, principally of cotton insects and other insects injurious or beneficial to agriculture." In two octavo volumes. "Only 15 copies of these plates were printed for private distribution. The drawings are dated 1854 to 1857. A number of plates of lepidoptera are added, produced by the mechanical transference of the wing-scales to paper."

By the same author, "Proofs from ten early copper plates, the author's first attempt at an illustrated work on entomology."

## EGG-LAYING OF LIMENITIS DISIPPUS.

Mr. Scudder asks (PSYCHE, v. 3, p. 30) if I am "confident that the several eggs on a given leaf were all laid by the same butterfly."

I cannot be absolutely sure of the first one laid on the leaf having four eggs, for that I did not see deposited—as I did the others—owing to the steepness of the bank and the low poplars which were abundant enough to impede my progress.

The eggs all hatched within twenty-four hours after the first larva appeared.

There was more difference in their pupation, the first and last being four days apart; and in their emerging there was a difference of six days between the first and last.

My whole experience with *L. disippus* was a surprise to me, for I had found but one or two larvae before last summer and had never seen the eggs, while, last summer, I found more larvae of *L. disippus* than of any other butterfly, and found so many eggs, on poplar leaves, that I gave up collecting them.

*Caroline G. Soule.*

## PROCEEDINGS OF SOCIETIES.

### CAMBRIDGE ENTOMOLOGICAL CLUB.

11 Dec. 1885.—The 115th meeting. [*Continued from v. 4, p. 338.*]

Dr. G: Dimmock showed samples of the different grades of Central American cochineal, carminic acid and some of its salts.

Dr. G: Dimmock showed specimens of several curious insects. Among them was a *Culex* with a parasitic nematod (*? Gordius*) dissected from its abdomen. The specimen was taken near Leipzig, Germany. The parasite was very large, relatively to the size of the *Culex*. No parasitic worms had been previously recorded from *Culex*, except *Filaria sanguinis-hominis*, altho *Mermis* had been found in *Simulium reptans*, in *Tanypus nebulosus* and in a species of *Chironomus*, and *Gordius* had been taken from *Chironomus plumosus*.

8 Jan. 1886. — The 116th meeting was held at 61 Sacramento Street, Cambridge, 8 Jan. 1886; the president, Mr. S: H. Scudder, in the chair.

Nominations nos. 132–133 were acted on, and the following persons elected to active membership: 132. George H. Parker, of Cambridge, Mass. 133. H. F. Gilbert, of Somerville, Mass.

Nominations nos. 134–135, both for active membership, were presented, as follows: 134. P. S. Abbot, of Cambridge, Mass. 135. Frank S. Child, of Cambridge, Mass. Both were nominated by Messrs. G: Dimmock and S: H. Scudder.

The report of the secretary for 1885 was read and approved. [An abstract of this report is appended to the report of this meeting.] The presentation of the report of the treasurer for 1885 was delayed on account of the illness of Mr. B: P. Mann. The secretary then made a special report on the condition of the library [an abstract of which follows the report of this meeting].

The following officers were elected for the ensuing year: president, S. A. Forbes; secretary, Roland Hayward; treasurer, B: Pickman Mann; librarian, George Dimmock; members at large of the executive committee, T. W: Harris and S: H. Scudder. Mr. B: Pickman Mann was elected editor of *Psyche*, with power to choose his associates.

The retiring president, Mr. S: H. Scudder, then delivered his annual address upon "The development of the hexapod type in time." This address, which has not been published, was supplementary to that delivered 13 Feb. 1885, on "The geological history of myriopods and arachnids." [*Psyche*, Jan.–Mar. 1885, v. 4, p. 245–250.]

Dr. G: Dimmock showed specimens of the larva, pupa, and imago of *Tinea cloacella*. The larvae feed in *Polyporus betulinus*.

Dr. G: Dimmock described a process of preparing the larvae of insects by boiling them in strong alcohol, and exhibited specimens prepared in this way. Among the specimens shown were lepidopterous larvae probably *pyralidae*, which were taken in October 1885 from the larger stalks of *Zizania aquatica* (Indian rice) growing in a small stream in Arlington, Mass, near the boundary line between that town and Cambridge. The larvae eat out the scanty pith partitions and the inner portions of the larger stalks. The larvae are from two to three centimetres long, dirty white in ground color, with longitudinal brownish stripes upon the upper side, and a dark brown head and pronotum. They have eight pairs of legs; a pair each on segments 1–3, 6–9, and 12.

*Abstract of Secretary's Report, 8 Jan. '86.* By G: Dimmock.

The present meeting of the club is the 116th. In the last annual report of the secretary the number of active members was reported to be twenty-seven; of associate members, forty-nine. During 1885 no new members have been elected, and three persons have withdrawn, leaving twenty-four active members. One associate member, Mr. H. K. Morrison, died during the year, leaving forty-eight associate members. . .

The officers of the club have continued over from 1884, because of a lack of a quorum at the meetings.

## BIBLIOGRAPHICAL RECORD.

*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name, as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic; G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

### Contribution to American Bibliography of Insect Diseases.

(*Continued from p. 20.*)

#### 1824.

**Cist**, Jacob. Notice of the *melolontha*, or may bug. (Amer. journ. sci. and arts, Aug. 1824, v. 8, p. 269-271, pl. 4.)

Report of the occurrence of *cordyceps* on *melolontha*. *S. A. F.* (4456)

#### 1849.

**Leidy**, Joseph. [On the existence of entophyta in healthy animals, as a natural condition.] (Proc. Acad. nat. sci. Phil., 9 Oct. 1849, v. 4, p. 225-233.)

Account of vegetable parasites of *julus*, *passalus* and other animals, including descriptions of the new genera *enterobrus*, *cladophytum* and *arthromitus*. *S. A. F.* (4457)

#### 1850.

**Leidy**, Joseph. [Entophyta in bodies of animals.] (Proc. Acad. nat. sci. Phil., 12 Feb. 1850, v. 5, p. 7, 8.)

Remarks on *mucor mucedo*, *achyla prolifera*, and some unnamed species in insects and crayfish. *S. A. F.* (4458)

**Leidy**, Joseph. [Entophytes in insects and myriapods.] (Proc. Acad. nat. sci. Phil., 19 Feb. 1850, v. 5, p. 8, 9.)

Remarks on species of *enterobrus*, etc. *S. A. F.* (4459)

**Leidy**, Joseph. Descriptions of new entophyta growing within animals. (Proc. Acad. nat. sci. Phil., 30 Apr. 1850, v. 5, p. 35, 36.)

Description of new genus (*eccrina*) and three new species. Remarks on development of *arthromitus*. *S. A. F.* (4460)

#### 1851.

**Leidy**, Joseph. [Remarks on parasitism of insects. (Proc. Acad. nat. sci. Phil., 1851, v. 5, p. 204, 210, 211.)

Account of culture experiment with fungus of mole-cricket (*gryllotalpa americana*). Dr. Leidy remarks that amount of parasitism in insects is influenced by kind of food. Hemipterous insects are remarkably free from parasites; those eating decaying substances especially subject to them. *S. A. F.* (4461)

#### 1858.

**Gray**, G: Robert. "Notices of insects that are known to form the bases of fungoid parasites. 4.° pp. 22, pl. 6. 1858."

"Privately printed by the author. No place of publication given on title-page, but probably London. A general summary with full account of literature of the subject, including American references and good plates reproduced from various sources." — *W: G. Farlow and W. Trelease* (Bibl. contrib., Libr. Harv. univ., no. 25, p. 17). *S. A. F.* (4462)

#### 1869.

**Riley**, C: Valentine. The periodical cicada. (First ann. rept. State entom. Mo., 1869, p. 18-42.)

On p. 26, remarks on the enemies of the cicada, with note of Dr. W. D. Hartman on a greenish powdery fungus found within it. *S. A. F.* (4463)

**Riley**, C: Valentine. The white grub. (First ann. rept. State entom. Mo., 1869, p. 156-159, fig. 88-89.)

On p. 158 are notes and a figure of a *cordyceps* on the larv a of the may-beetle. *S. A. F.* (4464)

## 1872.

[**Riley**, C; Valentine.] Remarkable parasitic fungus. (Sci. american, 25 May 1872, v. 26, no. 22, p. 347, col. 3, 16 cm.)

Figures a white grub with a *sphaeria* growing from its anterior end. *G: D.* (4465)

## 1883.

**Farlow**, W: Gilson. [Description of *botrytis rileyi* Farlow.] (Rept. U. S. dept agric., 1883, p. 121.)

Describes a new species of muscardine fungus found on the larvae of *plusia*. *S. A. F.* (4466)

**Riley**, C: Valentine. Reports of experiments, chiefly with kerosene, upon insects injuriously affecting the orange-tree and the cotton plant, made under the direction of the entomologist. (U. S. dept. agric.—Div. of entom.—Bull., no. 1, 1883,) p. 25.

Notice of a fungoid growth on *parlatoria* and *mytilaspis*, in a report made by Joseph Voyle. *S. A. F.* (4467)

## 1884.

**Leidy**, Joseph. Ant infested with a fungus. (Proc. Acad. nat. sci. Phil., 1 Jan. 1884, p. 9.)

Note on an undescribed fungus attacking *camponotus pennsylvanicus*. *S. A. F.* (4468)

## 1885.

**Fletcher**, James. [Remarks upon cut-worms.] (Fifteenth ann. rept. Entom. soc. Ontario, 1885, p. 21.)

Account of an enormous "fatality" among cut-worms [larvae of *agrotis*] caused by an entomophthorous fungus. *S. A. F.* (4469)

## 1886.

**Arthur**, Joseph C: A new larval *entomophthora*. (Botan. gaz., Jan. 1886, v. 11, p. 14-17, pl. 2.)

Describes and figures *entomophthora phytonomi* on *phytonomus punctatus*. *S. A. F.* (4470)

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[**Riley**, C: Valentine.] *Blepharoceridae*. (Amer. nat., July [22 June] 1881, v. 15.) (RILEY, C: V. Entomology . . . [July 1881]), p. 567-568.

Account of various investigations into the natural history of *blepharoceridae;* description of larvae and pupae of these flies. *B: P. M.* (4471)

[**Riley**, C: Valentine.] *Blepharoceridae*. (Amer. nat., Sept. [23 Aug.] 1881, v. 15.) (RILEY, C: V. Entomology . . . [Sept. 1881]), p. 748.

Records the discovery, by J. Q. Adams, of pupae and imagos of *blepharoceridae*, at Watertown, N. Y. *G: D.* (4472)

**Rudow**, Ferd. Einige beobachtungen über die lebensweise der heuschrecken. (Zeitschr. f. d. gesammt. naturwissensch., 1870, v. 36, p. 306-330.)
Rev. (BRAUER, F. Bericht . . . der entom. f. 1870, 1873, p. 26.)

Observations on the life-history and habits of certain orthoptera; among others the effect of food upon the color of the intestine of *locusta viridissima* and *decticus verrucivorus;* food, carnivorous habits and mode of capturing their prey in *locusta viridissima* and in *acrididae;* growth and the consequent color-changes, molting, hibernation, oviposition, mode of hopping and flying, and reproduction of lost limbs in saltatorial orthoptera; sonifaction in the males and its presence in the females of *locustidae*, its use as an attraction to the opposite sex, and its relation to the weather; sonifaction by males, females and larvae of the *acrididae*, and by *blatta;* experiments tending to show that saltatorial orthoptera hear with the antennae; breeding habits; contests between males and other modes of rivalry while in pursuit of females; copulation between different species and between larvae of saltatorial orthoptera. *G: D.* (4473)

**Rudow**, Ferd. Einige neue ixoden. (Zeitschr. f. d. gesammt. naturwissensch., 1870, v. 35, p. 14-20.)

Describes 6 new species of *ixodidae*. *G: D.* (4474)

**Rudow**, Ferd. Einige pupiparen auf chiropteren schmarotzend. (Zeitschr. f. d. gesammt. naturwissensch., 1871, v. 37, p. 121-124.)
Notice. (BERTKAU, Ph. Bericht . . . der entom. f. 1871-1872, 1876, p. 179.)

Describes 4 new species of *pupipara* from *chiroptera* ("mainly American"), as follows: *strebla longipes* from *phyllostoma hastatum*, *lipoptena dubia* from *noctilio dorsatus*, *nycteribia elongata* from *nyctophilus geoffroyi*, and *nycteribia varipes* from *miniopterus morio*. *G: D* (4475)

**Schöyen**, W. M. Bemaerkninger om enkelte variationer af vore rhopalocera. (Entom. tidskrift, 1885, v. 6, p. 139-144; Résumé, p. 214-215 )

Notes on specimens of *papilio machaon*, *pieris napi*, *argynnis freya* and *a. frigga* exhibiting colorational variation; on an anomalous specimen of *polyommatus phlaeas* with the ground color of the left anterior wing whitened; and on some varieties of *erebia:* considers the variation in *p. machaon* due to emergence under artificial conditions, and that of *p. phlaeas* due to accidental external influences on the pupa. *G: D.* (4476)

## ENTOMOLOGICAL ITEMS.

Dr. A. S. Packard has editorial charge of the entomological department of *Garden and forest*, a new weekly journal of horticulture, landscape art and forestry. The first numero is dated 29 Feb. 1888.

The Colorado potato-beetle in Europe.—The Colorado potato beetle has appeared in large numbers upon the potato-fields of Malitzsch, a village near Dommitzsch, in Saxony. It is believed, from the abundance of the beetles, that the species must have been introduced into that locality several years ago. The Prussian government is taking vigorous measures to exterminate the pest.—*Amer. naturalist*, Nov. 1887, v. 21, p. 1030.

Trap-door spiders.—Rev. Nendick Abraham communicates a brief paper to the Proceedings of the Zoological society of London, (1887, p. 40-43) "On the habits of the tree trap-door spider of Graham's Town," in which he describes the mode of construction of the nests of these spiders in crevices and holes of the bark of trees, the way in which they hold the door of their nests closed, how they catch their prey, and other habits.

Mental powers of spiders.—The second numero of the *Journal of morphology* (December 1887, issued in March 1888) contains a paper by George W. and Elizabeth G. Peckham, entitled, "Some observations on the mental powers of spiders." The paper fills thirty-six pages, and is subdivided as follows: 1, introduction; 2, sense of smell; 3, hearing; 4, maternal emotions; 5, sense of sight; 6, color-sense; 7. feigning death; 8, mistakes of spiders.

Nectar-secreting plant-lice. Oregon is the place for nectar-secreting plant-lice: During the past fall I received twigs of spruce and willow from that state, which, though not more than six inches [15 cm.] long, contained at least a tablespoonful of crystallized sugar, which was both pleasant and sweet. This insect is a species of *Aphis*, and though possibly not equal to the bee, or to the manufacturer of our best cane-sugar, in her power to form an excellent article of sugar does surpass greatly the glucose factories in the quality of the product which she turns out. —A. J. Cook (*Science* 29 Jan. 1886, v. 7, p. 102).

A scourge of mosquitoes.—The city of Mexico, for a number of months past, has been afflicted with a scourge of mosquitoes. These insects have prevailed to such an extent that they have been a constant theme of discussion, and have, in a number of instances, caused sickness, and, it is said, even death, by their poisonous bites. Official bulletins have been issued by the director of statistics, Dr. Peñafiel, seeking information as to their habits, natural history, etc. Singularly, the species, which is a large one, has not been known, or at least has not attracted attention before the past year; and fears are entertained that the pest is of recent introduction. The varying abundance of different kinds of insects during different years renders such a view improbable; yet it is significant that the present species is new to science, never having been described by entomologists.—*Science*, 15 Jan., 1886, v 7, p. 46.

Parasitic tineids, and wasps friendly to birds. — Occaionally, in a narrative of travels an interesting observation on insec-habits is made, and is very apt to be overlooked. Mr. E. A. Schwarz has handed us the following notes from "Die thierwelt im holländischen Guiana" von Aug. Kappler, *Ausland*, 1885. P. 617. No. 31. Speaking of *Bradypus cucculiger* [corr]. (Faulkner). an animal of the size of a cat, covered with a fur of dense hair-like wool; and belonging to the *Edentata*, he says "In this thick fur there lives as a parasite, a tineid, which when the animal is dead comes forth by the dozen and flies away." A parasitic tineid is certainly a curiosity.

P. 699, No. 35. Speaking of birds of the genus *Cacicus*, several of which inhabit Guiana, he says "Very remarkable are their friendly relations with several species of

*Polistes*, well known to the Indians and negroes. The nests of these birds are never seen without a nest of these wasps in the immediate vicinity—sometimes so near that the bird when entering its own nest, touches the combs of the wasps, which are not at all disturbed by this proceeding; but they vigorously resist any attempt to disturb the birds nests. I know three species which are thus friendly with these birds."—*Entom. americana*, Dec. 1885, v. 1, p. 178-179.

MIMETIC COLORATION OF PUPAE OF BUTTERFLIES.—In a paper by Gervase F. Mathew, entitled, "Life history of three species of western Pacific rhopalocera" (Trans. Entom. soc. Lond., 1885, p. 357-368), p. 364-365, after some remarks on the method employed by the author in rearing butterflies on board ship in empty biscuit tins, the following statement occurs:—

"The tins were secured upon a table in my cabin, and on the wall behind these were some pictures framed in maroon-colored velvet. One morning I noticed that a larva of *Papilio godeffroyi* had attached itself to a leaf which was almost touching one of these frames, and when I looked at it the next morning I was surprised to see that it had changed to a chrysalis of a beautiful deep rose-color. After this I thought I would try some experiments, so I pinned some twigs, to which were attached larvae that were on the point of changing, to pieces of cork, to which I had gummed scarlet, blue, black, yellow and white papers. Those placed on scarlet and white changed to rosy-pink chrysalids, those on blue and yellow to green, and those on black to very dark green. The chrysalids of *Papilio godeffroyi* have a thinner shell, and are more delicate than those of *Papilio schmeltzi*, and in consequence they were probably more susceptible to rays of light, for the former were more influenced by the color of the background than the latter. The newly changed chrysalids of both species were pale green, and it was not until several hours had elapsed that they assumed the color of their surroundings. They are also very soft, and are covered with a thin coating of some viscid substance, which may have the power of absorbing refracted rays of color-light as they dry and harden."

VITALITY OF THE LARVAE OF BALANINUS—In an article entitled "Vitality of the larvae of the nut-weevil," by F. W. Leggett, in the *Journal of the New York microscopical society*, for February 1886, v. 2, p. 30-31, the author writes:

Desiring to bleach a larva [of *Balaninus*] without destroying any of its softer parts, I placed one in a six-inch test-tube, filled to within one-half inch of its capacity, with peroxide of hydrogen, and here follows the result, as copied from memoranda made by me at the time: Put larva in test-tube at 7 p. m., Jan. 7th. Took it out at 5 p. m., Jan. 8th. Cut off a part of the side of the larva and mounted the piece cut off. At 7, the same evening, the creature was very lively. Placed it on a slide and looked at it through the microscope. The creature continued very lively the whole evening, altho the moisture from the wounded part dried, and fastened the larva firmly to the slide. Jan. 9th. 7.45 a. m., the the creature was still alive, altho the posterior end near the wound continued to be hard and dry. On Jan. 10th, at 2 p. m., I placed another larva of the nut-weevil in the same test-tube with the same peroxide of hydrogen, Like the former one, it immediately sank to the bottom, where it remained until Jan. 14th, at 7 p. m., when I removed it to a glass cup and laid it on its side. Into this cup I poured about twenty drops of water. On Jan. 15th, at 8.30 a. m., I found the creature expanding and contracting itself. Thinking that this motion might be an optical delusion on my part, I showed it to two members of my family. Both saw the movement distinctly, and further, when I touched the creature with a needle, saw it raise its head in an unmistakaby living manner. On Jan. 16, this larva was living and active.

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No. 143 was issued 9 March 1888.

# PSYCHE,

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 145.**

MAY 1888.


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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

# Psyche, A Journal of Entomology.

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*INDEX TO ENTOMOLOGICAL LITERATURE.*

Having accumulated an immense stock of references to the literature of entomology, I will furnish references on special subjects at ten cents each reference, or fifty cents per decade. For further particulars see PSYCHE for Oct.-Dec. 1884, v. 4, p. 223.

B: PICKMAN MANN,
Washington, D. C.

*LIBRARY OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.*

The librarian of the Cambridge Entomologica Club calls attention to the desirability of preserving in the library of the Club as complete a series of entomological publications as it is possible to collect. It is especially desirable to preserve the transient literature of the subject—separates, small pamphlets and newspaper articles—and the librarian will be pleased to receive single copies of the daily papers, scientific journals, magazines, or agricultural papers, which contain entomological articles. These papers are preserved and catalogd, and, because they are overlooked by large general libraries, are just the kind of material that should be preserved in a special entomological library. Any one who has sought for some of the best of the agricultural journals of the western states in libraries will appreciate any effort made to preserve journals of this sort.

Separates which are often thrown into the waste-basket, as useless, as too small for preservation, as duplications of parts of serials, or as valueless, are respectfully solicited. The friends of the Club are also asked to send a copy of newspapers in which they have published articles or notes on entomological subjects. If these notes are anonymous, the author's name will be acceptible information.

The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

Direct all papers for the library to

CAMBRIDGE ENTOMOLOGICAL CLUB,
Cambridge, Mass.

# BIOLOGICAL NOTES ON SOME NORTH AMERICAN ICHNEUMONIDAE.

BY CLARENCE MOORES WEED, COLUMBUS, OHIO.

The following memoranda concerning the life-history of some common species of *ichneumonidae* are based on a study of the collections and note boxes of the Illinois State laboratory of natural history, made during the winter of 1887-8, when the writer was connected with that institution. Though not of especial importance, it is believed that the observations here recorded will prove a useful contribution to our knowledge of the earlier stages of these interesting insects. All references to localities are to be understood as being in Illinois.

### PIMPLA NOTANDA Cresson.

Two specimens of this handsome species were bred at Normal, 12 and 29 August 1884, from larvae of *Gelechia gallaesolidaginis* Riley. Others were swept from grass in McLean County, 22 June 1883; and from wheat in Clark County, 22 May 1884.

### PIMPLA ANNULIPES Brullé.

During May 1887, a *Crambus* larva was found abundantly in a pasture field on the University farm, and a large number of specimens were placed under a bell-glass in the laboratory. The moths, which in all cases proved to be *Crambus exsiccatus*, began to emerge 24 May, and continued emerging until 9 June. At the latter date there were found in the cage a large number of specimens of *Apanteles crambi* Weed, a single example of *Pimpla annulipes* Brullé, and also a specimen of another large ichneumonid as yet undetermined. This was the only *Pimpla* bred from the lot, which consisted of something over a hundred *Crambus* cocoons.

Besides this bred specimen, a long series of this species were collected in the field. Localities and dates are as follows: Champaign County, 16 May, 12 June, and 3 July 1885 (sweepings); 7 Aug. 1886, and 15 Oct. 1887; McLean Co., 15 June, and 7 Nov. 1883; Tazewell Co., 14 Aug. 1883; Hancock Co., 26 June 1883 (sweepings in clover field); Marion Co., 20 Apr. and 20 May 1883 (sweepings in strawberry field); and in Knox Co.

### PIMPLA CONQUISITOR Say.

We have one specimen of this handsome insect bred from *Orgyia leucostigma* at Normal, 14 July 1883; and another was bred, 28 June 1884, from the pupa of some lepidopterous leaf-roller on grass—the precise species not being known, as but the one example was collected.

Of a large series collected in the field mention may be made of those taken at Normal from May to October during 1882, 1883 and 1884; and of a fine female specimen taken on flowers at Champaign, 20 Sept. 1886.

PIMPLA INQUISITOR Say.

This species has been twice bred from *Orgyia leucostigma;* and an adult was noticed by Mr. H. Garman, at Normal, 21 June 1883, "attempting to sting," a full grown *Orgyia* larva. Another was bred from what was supposed to be a phalaenid larva on apple in 1885 — the host being collected 10 June, and the adult parasite emerging 29 June. The species has also been taken in the field at various times — among others at Urbana 13 June 1885, and 3 Oct. 1887, and at Normal 13 June 1883.

PIMPLA ALBORICTA Cresson.

A single specimen of this beautiful little insect was bred at Normal, 11 Aug. 1884, from an unknown lepidopterous leaf-rolling larva on sycamore (*Platanus*).

GLYPTA VULGARIS Cresson.

Two specimens of this species were bred during the summer of 1884 from larvae of *Botys insequalis* collected in June on thistle heads. Another emerged 24 July 1883, from a chrysalis in the fold of a strawberry leaf collected at Normal. Others were taken in the woods in Tazewell Co. 14 Aug. 1883; and on apple trees in McLean Co., 3 May 1884.

GLYPTA SIMPLICIPES Walsh.

A single specimen of this insect was bred 8 August 1884, from the cocoon of some leaf-roller on apple —just what species I cannot say. Both *Teras minuta* (Robs), and *Cacoecia rosaceana* Harr., were present in the field of young apple trees from which the cocoon was taken.

TROGUS OBSIDIANATOR Brullé.

The only bred specimen of this species emerged 13 June 1885, from a lepidopterous cocoon supposed to be that of *Pyrrharctia isabella.* Other specimens were collected in McLean Co., 16 June and 13 July 1882, and 26 June 1885.

TROGUS EXESORIUS.

This insect seems especially to attack the larvae of species of *Papilio.* Dr. A. S. Packard has noted[1] that it infests *P. asterias*, *P. troilus*, *P. turnus*, *P. ajax* and *P. marcellus*, and Mr. Frederick Clarkson has also bred it from *P. troilus*, and has made the interesting observation that the point of exit of the parasite is "the same in every case, viz., on the right or left side, about midway of the thorax, at the widest part.[2]

Four larvae of *Papilio asterias* were collected on parsnip, 23 July 1885, at Champaign. One specimen pupated 27 July, another 28 July, another 30 July. The date of pupation of the fourth larva was not recorded, but the first butterfly emerged 5 August, and a second one 17 August. A live *Trogus* was found in the cage 25 August, and another emerged 5 Sept. Hence it appears that the parasite remains in the pupa state somewhat longer than its host.

Other specimens of this insect were collected at Bloomington 23 Sept. 1879; and at Champaign 8 July 1887, the latter being taken in the woods.

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[1]Proc. Bost. soc. nat. hist., Aug. 1881, v. 21, p. 21-22.

[2]Can. entom., Sept. 1883, v. 15, p. 162.

ICHNEUMON RUFIVENTRIS Brullé.

Two specimens of this handsome ichneumon were bred late in July 1884, from the chrysalids of *Pyrameis cardui*, the insects emerging as noted by Mr. Hart "by cutting a lid from the anterior end of the pupa." Other specimens were collected in Tazewell Co. during May, 1881, and in Union Co. 14 July 1880 and 14 Sept. 1883.

# IDENTIFICATION OF THE NOTODONTIAN GENUS SCHIZURA OF DOUBLEDAY.

BY ALPHEUS SPRING PACKARD, PROVIDENCE, R. I.

In *The entomologist* for Feb. 1841, Edward Doubleday, in an article entitled, "Characters of three new genera of *notodontidae* from North America," describes and figures *Schizura ipomeae* giving the generic and specific characters in some detail, and illustrating, in a plate facing p. 60, the larva and pupa from manuscript drawings by John Abbot.

When preparing the manuscript of a monograph of the *bombycidae*, which was published in abstract under the name, "Synopsis of the *bombycidae* of the United States" (Proc. Entom. soc. Phil., 1864, v. 3, p. 97-130, 331-396), I was unable with certainty to identify the genus (the species not then being known to occur north of Florida), but placed it next to my genus *Coelodasys*. In 1855 Walker referred it to *Heterocampa;* but neither Mr. Grote nor Mr. H. Edwards have been able to identify it. While looking over, during the past winter, the volume of manuscript colored drawings by John Abbot, in the library of the Boston society of natural history, I found the original colored drawing, copied by Doubleday and described by him as the larva of *Schizura ipomeae*. The larva figured by Abbot I recognized as that of *Coelodasys biguttatus* Pack. which I reared last summer in all its stages from eggs kindly sent me by Miss Emily A. Morton, of Newburgh, N. Y.

On comparing my specimen of *C. biguttatus* with Doubleday's description both of the generic and specific characters, it agrees exactly, and leaves no doubt but that my genus *Coelodasys* is a synonym of Doubleday's *Schizura*. Hence the former name should be dropped and that of *Schizura* retained, and *C. biguttatus* should, with little doubt, be regarded as a synonym of *S. ipomeae*. Of *Coelodasys* I described also *C. edmandsii* and *C. harrisii*, besides referring *Notodonta unicornis* to it. My *C. cinereofrons*, as previously shown by Grote, is a melanitic variety of *C. biguttatus*. All these species which are valid should, then, be referred to *Schizura*.

I may also add that I have identified Doubleday's *Heterocampa astarte*, as Grote had previously done: the larva is represented by Doubleday's fig. 1, the pupa by his fig. 2. His *Lochmaeus manteo* I have also readily identified; Grote's *Heterocampa subalbicans* is a synonym of it. Doubleday's unnamed larva, figs. 3 and 5, is that of Walker's *Cecrita guttivitta*, referred by Grote so *Heterocampa*, and which I have teen in its early and imago stages in Prof. Riley's collection, having also collected the caterpillar myself either in Rhode Island or Maine.

# PSYCHE.

CAMBRIDGE, MASS., MAY 1888.

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*Works on subjects not related to entomology will not be reviewed in* Psyche.

*For rates of subscription and of advertising, see advertising columns.*


## UNUSUAL COCOONS OF LIMACODES SCAPHA.

In October, 1887, Miss Ida M. Eliot sent me, from Nonquitt, Mass., several larvae of *L. scapha* on twigs of bayberry (*Myrica*).

To keep the food moist I put damp sand in a tin box, stuck the twigs into it, and placed the larvae on them.

One caterpillar made its cocoon in the usual way,—a tough, parchment-like case, but all the others spun bits of coarse sand into their cocoons, so that they look like nothing but lumps of sand. Beneath the sand, however, the cocoons show the normal kind and shape.

One larva added to the sand two bits of leaf, and the one which made the usual cocoon fastened it to a leaf.

*Caroline G. Soule.*

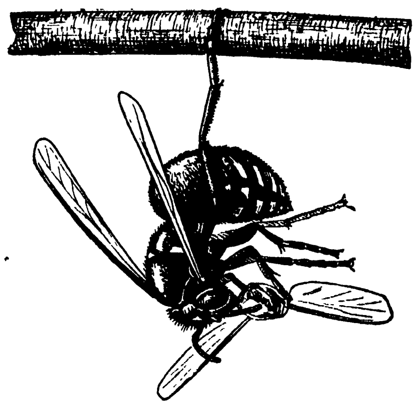
## NOTE ON MELITAEA PHAETON.

On the third of last August I found, in Jefferson Highlands, N. H., a nest of young larvae of *Melitaea phaeton*. It was formed, as described by Mr. W: H: Edwards, by drawing together the leaves of the *Chelone glabra*, and a fern had also been worked into its construction. I allowed the main part of the colony to remain where it was found, removing only a small detachment. The larvae that were removed ate one or two meals, certainly not more, before going into winter quarters in a small nest which they constructed in their new home. Visiting the main colony of larvae from time to time through the month to compare their habits with those of the larvae in confinement, I was surprised, at that time not being familiar with their history, to find that they too had ceased to eat. On the twenty-seventh of the month I placed my smaller detachment in proximity to the larger community, often removing the smaller lot to a fresh sprig of *Chelone*, and found that the larvae soon rejoined their old companions, with whom they are now hibernating.

*Holmes Hinkley.*

## HABIT OF VESPA.

While going through a swamp filled with alder bushes I noticed, hanging in the middle of one, a wasp devouring a fly in the position shown in the drawing. The wasp hung down by one foot. The abdomen was bent up out of the way. The half-eaten fly was held by the front feet, while the other legs and wings stuck out carelessly in all directions.



As the mandibles and antennae kept in rapid motion and the fly was turned over and over by the fore feet, the wasp swung slowly back and forth with the same appearance of comfort and enjoyment as a man eating an apple in a hammock. When the fly had been reduced to wings and shell the wasp let it drop, got up on the twig and flew away.

*James H: Emerton.*

## HABITS OF MYGALE IN CONFINEMENT.

Mr. Henry C. McCook has published (Proc. Acad. nat. sci. of Philadelphia for 1887) some notes on the habits of *Mygale hentzii* while kept in confinement in Philadelphia. Mr. McCook has had the best success in keeping spiders by feeding them well in summer and giving them but little during the winter, but lets them have all the water they want at all seasons. One *Mygale* lived over five years, and finally died soon after moulting, though it had moulted safely several times in previous years. The last moult happened in spring, before the spider had much to eat, and for this reason, probably, it was too weak to recover from the effects. One of Mr. McCook's mygales lost several limbs while moulting. He says "two of the legs refused to separate from the skin, and after a prolonged struggle they were broken off at the coxae and remained within the moult. One foot of another leg shared the same fate." This moult occurred in the spring. In August the spider moulted again, and by this time the lost limbs had grown again, complete but a little smaller than before.

The digging of these mygales was done with the fore legs and palpi. The dirt was not scratched up by the feet or kicked backward but gathered into balls between the mandibles, palpi and feet and carried away from the hole.

*James H: Emerton.*

## PROCEEDINGS OF SOCIETIES.

### CAMBRIDGE ENTOMOLOGICAL CLUB.

8 JAN. 1886. — The 116th meeting. [*Continued from p. 44.*]

*Abstract of the Secretary's Report on the Library, 8 Jan. 1886.* By G: Dimmock.

The circumstances which led the secretary to assume the duties of librarian are given in detail. . . .

The accession book has been written up to the end of 1885 and enumerates 1355 accessions. Of these 164 belong properly to the year 1885. . .

The books of the library have been classified by subjects according to the Dewey decimal classification. . . Only a small portion of the books are catalogd on slips. . . Some of the separates and smaller pamflets have been furnished with stiff manilla-paper covers, and many more separates need to be thus protected.

The rules concerning the loan of books remain the same as they were in 1882, when they were printed in our annual reports.

12 FEB. 1886.—The 117th meeting was held at 61 Sacramento St., Cambridge, 12 Feb. 1886. In the absence of the president, Mr. T. W. Harris was chosen chairman.

Mr. Roland Hayward remarked on the dilation of the first three joints of the middle tarsi of some of our species of *Dytiscus*. He asked if the patellae of the middle tarsi are functional or not.

Dr. G: Dimmock showed some specimens of *chrysomelidae* to illustrate the subject of color-variation, and made remarks upon experiments which he intended to try during the coming summer in order to produce color-varieties in insects.

12 MAR. 1886.—The 118th meeting was held at 61 Sacramento St., Cambridge, 12 March, 1886. In the absence of the president Prof. W: Trelease was elected chairman.

The report of the treasurer, Mr. B: P. Mann, for the year 1885 was read by the secretary, and having already received the approval of the auditing committee, was approved.

[An abstract of this report is appended to the report of this meeting.]

Nominations nos. 134–135 were acted upon and the following persons elected to active membership: 134. Philip Stanley Abbott, of Cambridge. 135. Frank Sedgwick Child, of Cambridge.

Nominations nos. 136–142, all for active membership, were presented, as follows: 136. Prof. T: J. Burrill, of Champaign, Ill.,

by Messrs. S. A. Forbes and W: Trelease. 137. W: H. Garman, of Champaign, Ill., by Messrs. Forbes and G: Dimmock. 138. Clarence M. Weed, of Champaign, Ill., by Messrs. Forbes and G: H. Parker. 139. Charles A. Hart, of Champaign, Ill., by Messrs. Forbes and F. S. Child. 140. T: F. Hunt, of Champaign, Ill., by Messrs. Forbes and R. Hayward. 141. Prof. C: Robertson, of Carlinville, Ill., by Messrs. Forbes and S: H. Scudder. 142. C: W: Woodworth, of Champaign, Ill., by Messrs. Forbes and Dimmock.

The receipt of an invitation to attend the celebration of the fiftieth anniversary of the Verein für naturkunde, in Cassel, Germany, was announced, and Messrs. S: H. Scudder and R. Hayward were appointed a committee to draft suitable resolutions.

Mr. S: H. Scudder remarked on a pre-historic beetle. Borings made by this insect had been found in juniper, which had been discovered in beds of the inter-glacial period. The species belongs to the *scolytidae*, probably to the subfamily *hylurgini*, as defined by Leconte and Horn. The paper was illustrated by drawings of the borings of this species, and those of existing *scolytidae*.

Dr. G: Dimmock showed a female of *Hippodamia convergens*, which had hibernated in a cold cellar. The beetle had copulated but once, and that in the fall. Dr. Dimmock gave statistics of the eggs which this beetle had laid, and which proved fertile, and made further remarks upon rearing *coccinellidae*.

Mr. S: H. Scudder made some remarks on *Melittia cucurbitae* and a related species. [See PSYCHE, July–Sept. 1885, v. 4, p. 303–304.]

*Abstract of Treasurer's Report, 12 Mar. '86.* By B: Pickman Mann.

Open accounts have been kept seperately with each volume of PSYCHE, or the years to which each corresponds. The account for volume one shows a deficit of $16.05; that of volume two, $239.59; that for the years 1880 to 1882, inclusive, a balance on hand of $34.59; that of volume four, not yet completed, already shows a deficit of $150.66. The principal of the permanent publication fund amounts to $386.39. [The Treasurer's report was duly audited and approved.]

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ENTOMOLOGICAL SOCIETY OF LONDON.

*(Continued from v. 4, p. 314.)*

1 OCT. 1884.—Mr. R. McLachlan exhibited a specimen of *nemopteridae*, which was captured by Mr. J. J. Walker at Coquimbo. This was remarkable as hitherto no species of this family had been known to occur in America. This new species appeared to come nearest to *Brachystoma* Rambur.

Baron C: R. Osten Sacken communicated "Facts concerning the importation or non-importation of diptera into distant countries."

3 DEC. 1884.—Baron C: R. Osten Sacken was elected an honorary member of the society.

Mr. A. S. Olliff exhibited *Aciphus singularis*, recently described in the "*Entomologist's monthly magazine*," from Brazil. It had the appearance of one of the *staphylinidae*, but was a *Cucujus* strongly resembling *Diagrypnodes wakefieldii*, from New Zealand.

Mr. C: O. Waterhouse exhibited a specimen of *Julodis finchi* from Karachi, a buprestid of nearly twice the size of the largest hitherto known species, and recently described by him in the "*Annals and magazine of natural history*."

Rev. Leonard Blomfield contributed a note on a beetle taken near Bath, England, which proved to be *Monohammus titillator*. It was taken by a man engaged in chopping wood that proved to be North American pine, and was the second specimen that had been taken alive in England.

Mr. H. J. S. Pryer contributed a paper "On two remarkable cases of mimicry from Elopura, British North Borneo, with remarks on Mr. George Lewis' paper read before the society on 4th October 1882" . . . [Several cases of mimicry were cited by Messrs. Butler and Waterhouse in discussing Mr. Pryer's paper; these citations are given in detail in the Proceedings.]—Abstracted and compiled from the *Trans. Entom. soc. Lond.*, 1884; Proc.

## BIBLIOGRAPHICAL RECORD.

*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name. as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

**Bassett**, Homer Franklin. New *cynipidae.* (Can. entom., April 1881, v. 13, p. 74-79; May 1881, v. 13, p. 92-113.)

Describes 24 new species of *cynipidae.* *G: D.* (4477)

**Beard**, Daniel C. The Florida "mule killer," *thelyphonus giganteus* (Sci. amer., 5 Mar. 1887, v. 56, p. 153, 40 cm.)

Figures *thelyphonus giganteus* and gives notes on its habits; mentions a case of a man seriously injured by bites of this arachnid, and of two mules killed by bites of *thelyphonus.* *G: D.* (4478)

**Bertkau**, Philipp. Bemerkungen zu Schimkewitsch's notiz "Sur un organe des sens des araignées" in Zool. anz., no. 201, p. 464. (Zool. anzeiger, 14 Sept. 1885, v. 8, p. 537-538.)

Rev. of W. Schimkewitsch's "Sur un organe [etc.]" (*op. cit.*, 10 Aug. 1885, p. 464-466) [Rec., 4485]; notes on the structure of supposed auditory organs on the legs of *araneina*, with reference to what the author had already published on the subject. *G: D.* (4479)

**Clayes**, S. L. Cobwebs and how they are made. (Swiss cross, Jan. 1888, v. 3, p. 10-11, 57 cm.)

Mode of web-making by *epeira diadema.* *G: D.* (4480)

**Müller**, Hermann. Explanation of the female dimorphism of *paltostoma torrentium.* (Nature, 7 July 1881, v. 24, p. 214, 10 cm.)

In explanation of the female dimorphism of *paltostoma torrentium*, and the theories concerning it advanced by Fritz Müller (Kosmos, Oct. 1880, v. 8, p. 37-42) [Rec., 4444], the author mentions that in *empis punctata* the males suck nectar, while a part of the females do the same, and the others "attacked, murdered, and consumed" *rhingia rostrata*, a fly belonging to the *syrphidae.* *G: D.* (4481)

**Müller**, Fritz. Einige worte uber *leptalis.* (Jenaische zeitschr. f. naturwiss., Feb. 1876, v. 10, p. 1-12, il.)

Abstract, entitled, "Mimicry in butterflies explained by natural selection." (Amer. nat., Sept. 1876, v. 10, 534-536.) [Rec., 1017.]

Abstract. (Ann. record of sci. and industry, . . . S. F. Baird, 1876, p. 283-284.)

Discussion of mimicry, based upon studies of species of *leptalis* found in southern Brazil. *H: W. T.* (4482)

**Müller**, Fritz. Os orgaos odoriferos nas pernas de certos lepidopteres [e supplemento]. (Arch. do. Museu nacional do Rio de Janeiro, 1877, v. 2, p. 37-46, pl. 4-5.)

Notes on the various kinds of odoriferous organs and their situations in the lepidoptera; those which consist of tufts on the legs are more fully described, both in general aspect and in minute structure, and figures of these tufts and the modified scales which form them in *pantherodes pardalia* and in an erebid moth are given. *G: D.* (4483)

**Schaupp**, Frank G: Fertile eggs from a dead *arctia virgo.* (Bull. Brooklyn entom. soc., Feb. 1883, v. 5, p. 81.)

Eggs extracted from the body of *arctia virgo* hatched; might not larvae of a rare species be obtained similarly? *B: P. M.* (4484)

**Schimkewitsch**, Wladimir, Sur un organe des sens des araignées. (Zool. anzeiger, 10 Aug. 1885, v. 8, p. 464-466.)

Rev., by P. Bertkau, entitled "Bemerkungen zu Schimkewitsch's notiz "Sur un organe [etc.]." (*op. cit.*, 14 Sep. 1885, p. 537-538.)

Describes position and structure of sense-organs, comparable to Graber's chordotonal poriferous organs of insects, which are located on the palpi and legs of spiders. These organs are the same as those noted by F. Dahl, in his "Das gehör- und geruchsorgan der spinnen." (4485)

**Shorten**, J: W. *Macrosila cingulata*. (Journ. Cincinnati soc. nat. hist., April 1882, v. 5, p. 62.).

Records the capture of *macrosila cingulata* in the vicinity of Cincinnati, Ohio. *G; D.* (4486)

**Siewers**, C: Godfrey. Coleoptera. (Journ. Cincinnati soc. nat. hist., July 1882, v. 5, p. 96.)

Notes captures of *necrophilus subterraneus, limonius aurifer, strongylium crenatum*, and a variety of *arthromacra aenea*. *G: D.* (4487)

**Siewers**, C: Godfrey. *Formica ruber* and *formica niger*. (Journ. Cincinnati soc. nat. hist., April 1882, v. 5, p. 60-61.)

Describes a foray of a nest of red ants against a nest of black ants, in which the latter were made slaves; adds a few further remarks on the habits of queen ants and their slaves. *G: D.* (4488)

**Smith**, J: B. New noctuids and notes. (Bull. Brooklyn entom. soc., Jan. 1883. v. 5, p. 67-68.)

Describes *calymnia aequilinea* from Colorado, and *hadena juncimacula* from Utah, new species, each from one specimen; "*mamestra promulsa*" is not an *anarta*, as catalogued by A: R. Grote. *B: P. M.* (4489)

**Taschenberg**, E. L. Zur kenntniss der gattung *calopteron* Guér. (Zeitschr. f. d. gesammt. naturwissensch., 1874, v. 44, p. 79-102.)

Notice. (Bertkau, Ph. Bericht . . . der entom. f. 1873-1874, 1877, p. 97.)

Describes 21 new species of *calopteron* from South America. *G: D.* (4490)

**Vion**, René. L'auscultation des arbres. (Bull. Soc. linn. du nord de la France, 1881, v. 5, p. 350.)

Abstract of J. T. Bell's "Arboreal auscultation" (Can. entom., Jan. 1881, v. 13, p. 19-20) [Rec., 2224]. *G: D.* (4491)

**Vion**, René. Comment les insectes endurent l'hiver. (Bull. Soc. linn. du nord de la France, 1880, v. 5, p. 111-112.)

Notes from Miss E. A. Ormerod's observations, showing that the effect of very severe winters upon insect life is not to destroy the insects, as hes been supposed. *G: D.* (4492)

**Vion**, René. L'entomologie en Amérique. (Bull. Soc. linn. du nord de la France, 1881, v. 5, p. 312-314.)

Abstract of the account of the meeting of the Entomological section of the American association for the advancement of science, at Boston (Mass.), in 1880, as given in the *Canadian entomologist*, Sept., 1880, v. 12, p. 161-174) [Rec., 2486]. *G: D.* (4493)

**Vion**, René. Les fourmis à miel. (Bull. Soc. linn. du nord de la France, 1882, v. 6, p. 87-90.)

Abstract of H: C. McCook's "The honey ants of the Garden of the gods" (Proc. Acad. nat. sci. Phil., 1881, p. 17-77, pl. 1-10) [Rec., 4433]. *G: D.* (4494)

**Vion**, René. Moyen de détruire les nids de guêpe. (Bull. Soc. linn. du nord de la France, 1882, v. 6, p. 185-186.)

A mode of killing the wasps in a nest by putting powdered cyanide of potassium [KCN] at the entrance of the nest; a nest so treated contained over 3,400 wasps. *G: D.* (4495)

**Vion**, René. Résurrection des tardigrades par l'humidité. (Bull. Soc. linn. du nord de la France, 1882, v. 6, p. 27-28.)

Brief résumé of the views held by various authors upon the subject of the restoration of tardigrades after they have been dried, and of the results of experiments on this subject in Jung's "Das wiederaufleben eingetrockneter tardigraden" (Zeitschr. f. d. gesammt. naturw., 1881, v. 54, s. 3, v. 6, p. 190-192) [Rec., 4410]. *G: D.* (4496)

**Vion**, René. Ruses d'une guêpe. (Bull. Soc. linn. du nord de la France, 1880, v. 5, p. 112.)

Abstract of a note by Seth Green (*New York world* . . .) describing how a wasp, by shaking a spider's web, attracted the spider out of it, and then killed the spider. *G: D.* (4497)

**V[ion,]** R[ené]. La sélection chez les papillons. (Bull. Soc. linn. du nord de la France, 1880, v. 5, p. 15-16.)

Notes from Fritz Müller on the sexual dimorphism of *epicalia acontius*. *G: D.* (4498)

**Vion**, René. Le sens des couleurs chez les abeilles. (Bull. Soc. linn. du nord de la France, 1882, v. 6, p. 58-59.)

Notice of some of J: Lubbock's experiments upon the ability of *apis mellifica* to distinguish colors. *G: D.* (4499)

**Vion**, René. Le venin de l'abeille. (Bull. Soc. linn. du nord de la France, 1882, v. 6, p. 186-187.)

Notes on the role played by formic acid [$CH_2O_2$], in the sting of the bee [*apis mellifica*], and the preserving power which the same acid has in the bees' honey; mention of some other organisms which contain this acid. *G: D.* (4500)

**Weyenbergh**, Hendrik. Bibliographie scientifique, principalement zoologique, du Dr. H. Weyenbergh. (Periód. zool. argent., 1881, v. 3, p. 329-361.)

Separate, with t.-p. cover. 34 p. 23 × 16, t 16 × 9.6.

Contains a list of 152 papers, many of them upon insects, by Dr. H. Weyenbergh, and a list of the new species of animals described in these papers. *G: D.* (4501)

**Young**, J: N. Breeding moths in confinement. (Rec. and observ. Rotherham nat. soc., July 1884, no. 1, p. 10-11.)

Account of breeding specimens of *liparis monacha* from the egg; and of failure to continue the breeding without introducing "new blood," that is of males not descended from the same parents as the females. *G: D.* (4502)

## ENTOMOLOGICAL ITEMS.

SPHINGIDAE OF NORTH AMERICA.—The American entomological society will issue shortly a monograph of the *sphingidae* of America north of Mexico, by Mr. John B. Smith.

PUPA OF DANAIS ARCHIPPUS.—A paper, by Mr. J. H. Emerton, describing the anatomy of the chrysalis of *Danais archippus* will appear in an early numero of the Memoirs of the Boston society of natural history. A plate will illustrate the paper.

A NEW APPOINTMENT.—Mr. Clarence M. Weed, for some time an assistant of Prof. S. A. Forbes, at Champaign, Ill., has been appointed entomologist to the Ohio agricultural experiment station, at Columbus, Ohio, where all correspondence for him should be addressed.

APHIDIDAE AND THEIR FOOD-PLANTS.—Bulletin no. 4 of the Geographical and natural history survey of Minnesota contains a synopsis of the *aphididae* of the state by Prof. O. W. Oestlund. A list of North American plants with species of *aphididae* known to attack them is added.

A NEW ELEMENTARY ENTOMOLOGY.—Prof. A. S. Packard has prepared an Entomology for beginners, which will be published in June by Henry Holt and company. The book will contain brief descriptions of the principal families of all orders, followed by directions for collecting and preserving insects, a chapter on injurious insects, &c. The work will be fully illustrated.

COLOR-PREFERENCE IN ANTHRENUS.—The following curious note is taken from a paper by John B. Smith, entitled, "Some observations on museum pests" (Proc. Entom. soc. Washington, 1887, v. 1, no. 2), p. 115.

"As a rule *Anthrenus* can hardly be considered fastidious, but occasionally they manifest color preferences. In one specimen of *Grapta interrogationis* the black spots bordering on the costa were neatly cut out, no other portion of the wing being touched. Its career was suddenly cut short before it had quite finished one wing, and I now regret that I did not allow it to continue its work to note whether it would have attacked the other wing in the same manner."

ON THE SEXES OF LEPIDOPTEROUS larvae.—Mr. J. A. Weniger, in an article with the above title, published in the *Entomologist* for April 1887, states that the sex of some of the larvae of *Attacus* can be distinguished, in the later larval stages, by examination of the under side of the last segment that bears stigmata. In the female, on the middle of the ventral side of this segment, there is a dark blotch, in natural size not larger than the head of a pin, and the middle of this blotch has a yellowish tint. In the male the same blotch is present, but its "middle is a dark green spot, which gives the appearance of a hole: this is only from the internal organs, and is a liquid substance; for should a larvae of each sex be killed and emptied, nothing of the signs will remain." Mr. E: B. Poulton, in a note following Mr. Weniger's communication thinks it should be confirmed by further observation, but adds: "It is quite clear that, as Mr. Weniger implies, the markings have not the value of external organs of reproduction, but if their presence is confirmed they will prove to be the blind terminations of the ducts of the sexual glands, which should be found beneath the cuticle at this very spot, as Herold showed, in the case of the larva of *Pieris brassicae*, towards the beginning of this century."

HOUSEHOLD PESTS.—The publishers of *Good housekeeping* (Springfield, Mass.) offer four prizes, each of twenty-five dollars, for recipes or treatment against household pests. The first prize is for an exterminator for the so-called Buffalo-bug (*Anthrenus scrophulariae*), the second for the bed-bug (*Cimex lectularius*), the third for moths, and the fourth for flies and fleas. The mode of treatment will be published in *Good housekeeping*, "and afterwards have a test of merit at the

hands of a committee, composed of three competent housewives, and, upon satisfactory tests being had, cash prizes will be awarded. The treatment in all cases must be safe for handling, and in no way deleterious to the person, texture, or household belongings of any kind."

The notice of these prizes appears in the numero of *Good housekeeping* for 28 April 1888, but no definite time is set for sending in descriptions of competing methods.

COLORATION OF COCOONS AND PUPAE.—In continuation of an item entitled "Mimetic coloration of pupae of butterflies" in the April numero of PSYCHE (p. 48), the following extracts are given, taken from reports, by Herbert Goss, of the proceedings of the Entomological society of London, at the meetings of 2 Nov. 1887, and 7 March 1888, as published in the *Entomologist*, Dec. 1887, v. 20, p. 331-332, and April 1888, v. 21, p. 119.

"Mr. E. B. Poulton exhibited (2 Nov. 1887) the cocoons of three species of lepidoptera, in which the color of the silk had been controlled by the use of appropriate colors in the larval environment at the time of spinning up. Mr. Poulton said this color susceptibility had been previously proved by him in 1886 in the case of *Saturnia carpini*, and the experiments on the subject had been described in the Proc. Royal society, 1887. It appears from these experiments that the cocoons were dark brown when the larvae had been placed in a black bag; white when they had been freely exposed to light with white surfaces in the immediate neighborhood. Mr. Poulton stated that two other species subjected to experiment during the past season afforded confirmatory results. Thus the mature larvae of *Eriogaster lanestris* had been exposed to white surroundings by the Rev. W. J. H. Newman, and cream-colored cocoons were produced in all cases; whilst two or three hundred larvae from the same company spun the ordinary dark brown cocoons among the leaves of the food-plant. In the latter case the green surroundings appeared to act as a stimulus to the production of a color which corresponded with that which the leaves would subsequently assume. Mr. Poulton further stated that he had more recently exposed the larvae of *Halias prasinana* to white surroundings, and had obtained a white and a very light yellow cocoon—far lighter than the lightest of those met with upon leaves. The larva which spun the white cocoon had previously begun to spin a brown one upon a leaf, but upon being removed to white surroundings it produced white silk. Mr. Stainton suggested that larvae should be placed in green boxes, with the view of ascertaining whether the cocoons would be green. He understood that it had been suggested that the cocoons formed amongst leaves became brown because the larvae knew what color the leaves would ultimately become. Mr. Poulton said he felt convinced that the whole process was entirely involuntary, and that the susceptibility had arisen through the action of natural selection."

"Mr. W. White read (7 March 1888) a paper on 'Experiments upon the color-relation between the pupae of *Pieris rapae* and their immediate surroundings,' which comprised a detailed account and discussion of a series of observations carried on, at the author's instigation, by Mr. G. C. Griffiths, of Bristol. The various experiments were intended to act as a further test of the conclusions arrived at by Mr. E. B. Poulton in his paper on the subject recently published in the Transactions of the Royal society; and to effect this object different and additional influences had been brought to bear on these pupae, so that an analogy might be drawn between the two sets of results."

The above notes are given in full, in the hopes that American breeders of insects will try experiments in this direction. The expense, both of time and money, in carrying on this kind of experimenting is little, while the results, if the work is carefully done, are very valuable contributions to physiological knowledge. *G: D.*

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No. 144 was issued 13 Apr. 1888.

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 146.**

JUNE 1888.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

*INDEX TO ENTOMOLOGICAL LITERATURE.*

Having accumulated an immense stock of references to the literature of entomology, I will furnish references on special subjects at ten cents each reference, or fifty cents per decade. For further particulars see PSYCHE for Oct.-Dec. 1884, v. 4, p. 223.

B: PICKMAN MANN,
Washington, D. C.

*LIBRARY OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.*

The librarian of the Cambridge Entomologica Club calls attention to the desirability of preserving in the library of the Club as complete a series of entomological publications as it is possible to collect. It is especially desirable to preserve the transient literature of the subject—separates, small pamphlets and newspaper articles—and the librarian will be pleased to receive single copies of the daily papers, scientific journals, magazines, or agricultural papers, which contain entomological articles. These papers are preserved and catalogd, and, because they are overlooked by large general libraries, are just the kind of material that should be preserved in a special entomological library. Any one who has sought for some of the best of the agricultural journals of the western states in libraries will appreciate any effort made to preserve journals of this sort.

Separates which are often thrown into the waste-basket, as useless, as too small for preservation, as duplications of parts of serials, or as valueless, are respectfully solicited. The friends of the Club are also asked to send a copy of newspapers in which they have published articles or notes on entomological subjects. If these notes are anonymous, the author's name will be acceptible information.

The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

Direct all papers for the library to

CAMBRIDGE ENTOMOLOGICAL CLUB,
Cambridge, Mass.

# THE NATURAL HISTORY OF *ANOSIA PLEXIPPUS* IN NEW ENGLAND.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

This butterfly passes the winter in the imago state. In southern latitudes, according to Edwards, who has given it closest attention, it appears early in the spring and lays eggs upon the milk-weed just out of the ground, beginning in West Virginia in the early part of May. The insect matures there very rapidly, and passes through several generations, according to Mr. Edwards at least three, and probably four, in the course of the season, the latest brood of the butterflies hibernating. Riley, who was the first to give a tolerably full life history of the insect, claimed that in Missouri it was double-brooded, the broods appearing in the latter half of June and in October. In New England, however, what we can learn of the butterfly indicates a somewhat different history. Some years ago, in publishing an account of its history here, I claimed that the insect was only single-brooded, first coming out of hibernation at the end of June and early in July, laying eggs for a month or so, and the butterflies from these eggs hibernating. A great many points concerning its history both here and elsewhere have been brought out since then, and the facts as we know them at present may probably be interpreted somewhat in this way.

The butterflies, which are far more numerous in the late autumn than at any other time, seek winter quarters to hibernate, but with very rare exceptions, north of the natural division line of the Canadian and Alleghanian faunas, and even to a considerable distance to the south of this, possibly sometimes throughout the entire district of New England, every single specimen perishes. Now and then an old and battered female may be found in the month of May, but we have actually on record as far as I can discover but two or three instances of this, and one of these is not specific. A female much worn and faded was found May 12 at Amherst by Professor Parker. and in another year the butterfly was found by Mr. W. D. Marsh on May 15 and May 21 at the same place; while Mr. Caulfield speaks in general terms of the appearance of butterflies in Montreal in May. In the

extreme southern portions of New England and the neighboring districts, we have not infrequent appearances of hibernating butterflies early in May. But neither hibernators nor their progeny, in the preparatory stages — the only absolutely certain proof of an early brood, — are with possibly rare exceptions to be found in the northern half or more of New England either in May or early in June. The first occurrence of the insect there in any form is much later in the season, generally by the middle of June, occasionally by the very first, sometimes not until the very end of this month, when fine fresh butterflies make their appearance, at about the same time as, or a trifle later than, the advent a little further south of the first fresh brood of butterflies from eggs of the same season,—thus giving all the appearance throughout New England of an identical swarm of butterflies, varying in time from those found next the southern borders of New England only so much as would be expected from latitude.

This brood is in my opinion to be accounted for only on the supposition that they are *colonists from the south* which have flown to more northern districts from that impulse to wander which is one of the psychological characteristics of this butterfly. This hypothesis is further supported by the essentially tropical nature of the butterfly, which would prevent its establishing itself as a permanent resident rather than as an annual visitor of northern districts; by its well-known vast power of flight; as well as by its comparative history in the south. These butterflies begin in New England to lay their eggs usually in the first week in July, but occasionally as early as the middle of June. Dr. Harris records some caterpillars found on the 28th of June which had reached the length of an inch on the 5th of July, and I have found them in Shirley, Mass., of the length of six millimetres, therefore probably in the second stage, on the 22d of June. These were unusually early caterpillars of the brood which had flown from the south and which sometimes makes its advent early in June. Both Mr. F. H. Sprague and myself have found them about Boston as early as the 2d of this month in good condition, and single additional specimens were found in the same year by Mr. Sprague on the 9th and 15th of June. They never, however, become at all abundant before the first week in July, when the eggs are ordinarily laid. The eggs continue to be laid throughout this entire month without any interruption.

As regards the later history of this butterfly in the north, we are still somewhat in doubt. Mr. Edwards urges with great pertinacity that the behavior of the butterfly in the north is altogether parallel to its behavior in the south, but this would hardly seem as yet to be settled; at any rate the appearance of the latest fresh butterflies of the season may easily be accounted

for on the supposition that they were produced from eggs laid by the older females of the first brood of colonists. For the observer will notice that eggs are laid by butterflies both in a fairly fresh condition and also by those which have been upon the wing a long time, and the closest observations I have been able to give through many summers both of butteiflies seen in the act of depositing their eggs and of the contents of the ovaries of others, lead me strongly to the conviction that this butterfly requires more than a brief time for oviposition, the eggs maturing by degrees and not being fully laid until the butterfly has been upon the wing about an entire month. The examination of butterflies fresh from the chrysalis shows that the eggs are never entirely mature at this time, while on the other hand these butterflies retain their freshness of appearance for a longer time than usual after they have come from the chrysalis. That there is easily time for a second brood of butterflies from eggs laid by the progeny of the first colonists (basing our judgment upon the facts as given us by Mr. Edwards in the south), there can be little doubt, but the proof of such a second brood has yet to be given. While, therefore, I am compelled by the facts that have been advanced since my former account of this species was published to modify my views in one respect, I am still inclined to think it in the main correct, viz., that this butterfly is normally single brooded throughout the larger part of New England; but that it requires an annual visitation of colonists from the south to exist at all, the hibernating butterflies perishing annually, almost to an individual.

Mr. Edwards entertains a different opinion regarding its life history in New England and does not believe that the butterflies which have hibernated perish to any such extent as I have presumed; and, because single instances of hibernating butterflies have been found in Massachusetts, he considers that "this settles the matter." But he fails to mention the fact that during the year 1887 when one observer found two of these hibernating butterflies in May at Amherst, this observer (Mr. Marsh), who was constantly on the watch for this butterfly, discovered but these two specimens in the season, while a number of Mr. Edwards' New England correspondents, whom he had similarly put upon a special search, were unable to find any; nor does he take note of the fact that Amherst, the only place in which these hibernating butterflies have yet been found in so northern a latitude as Massachusetts, is in the Connecticut valley, where the isotherms trend northward; and which is but a comparatively short distance north of those parts of southern Connecticut, in the valley of the same river. where it is not improbable that successfully hibernating butterflies may be found in all favorable years; nor is he perhaps aware that the valley of this river is one in which southern butterflies find their way far-

ther north than at any other point in New England excepting in some instances along the sea-board.

My own collecting in New England, where this butterfly is much less common than further south, leads me to believe that it is far easier to obtain it by search for the caterpillar on the leaves of *Asclepias* than by capture upon the wing; and I should rather decide upon the presence of butterflies in any particular district by a search for plants of *Asclepias* in suitable spots, than by watching for the butterflies; so that the failure year after year to find such larvae on young and tender plants in the very spots which are invariably chosen by the July butterflies whereon to deposit their eggs is to me very strong proof that the butterfly does not ordinarily exist in any form during the early months of the year in regions that I have searched. Regarding the later broods it may be added that the observations of Mr. Marsh, who raised butterflies as late as the latter half of October and even in November, were made in part at least upon housed larvae and that at this late epoch of the year the transformations of the insect are very much slower than they are earlier in the season. Thus Mr. Marsh himself states that the pupal period in October is about three weeks, while in September it is only about a fortnight. In midsummer it is about ten days.

Mr. Edwards, accepting a suggestion of Mr. Marsh, further urges that the failure to discover the hibernators in the spring is due to their rarity in the autumn and the latter from the fact that in New England the fields are often mowed for a second crop and that with the hay great quantities of milk-weed are cut down. But aside from the fact that the larger part of the milk-weeds inhabited by the caterpillars is found by the side of roads and lanes and in close vicinity to shrubbery, where it is not disturbed by the scythe, there is a single fact which renders this argument absolutely useless, viz., that the imago is far more abundant late in the season than at any other time in the year, sometimes swarming to an excessive extent and found in New England in the same abundance that it is so often found in the west. Yet so far as I have been able to find from inquiries (unfortunately not made at the time), in no instance have hibernators been seen in years immediately succeeding autumns which have witnessed a vast profusion of butterflies, nor have autumns of great abundance been followed by springs of plenty.

# SYNOPSIS OF NORTH AMERICAN CICADIDAE.

BY CHARLES WILLIAM WOODWORTH, CAMBRIDGE, MASS.

The following synopsis will enable one to easily distinguish our North American species.

## GENERA.

*A.* Second abdominal segment of the male expanded and partly or wholly concealing the tympanum.

*B.* Side margins of the thorax expanded horizontally. *Zammara.*

*BB.* Side margins of the thorax not horizontal, hardly expanded.

*C.* First apical crossvein oblique.

*D.* Basal cell of anterior wing less than twice as long as broad. *Cicada.*

*DD.* Basal cell of anterior wing twice as long as broad. *Tettigia.*

*CC.* First apical crossvein forming right angles with the principal veins. *Proarna.*

*AA.* Second abdominal segment of the male not expanded. Tympanum free or wanting.

*E.* Ulnar veins separate and distinct at base.

*F.* Tympannum present *Tibicen.*

*FF.* Tympanum wanting, wings rather shorter and broader than usual, cells wide. *Platypedia.*

*EE.* Ulnar veins united at base. *Melampsalta.*

## SPECIES.

*Zammara* Am. & Serv.

*smaragdina* Walker.

*angulosa* Walker.

San Diego, California; also Mexico.

*Cicada* Linn.

*a.* Opercles rounded behind in both sexes.

*b.* Wings unclouded except at the crossveins.

*c.* A median dorsal row of white spots on the abdomen above. *dorsata.*

*cc.* No dorsal white spots on the abdomen.

*d.* Male genitals broad, median dorsal spine generally short, blunt, or wanting. Anterior prothoracic spots generally separated from the others. *marginata.*

*dd.* Male genitals narrow, median dorsal spine generally large and acute. Anterior prothoracic spots always united with the others. All generally forming a broad V-shaped spot. *tibicen.*

*bb.* Wings clouded at their tips, body green marked with black. *superba.*

*aa.* Opercles white, pointed behind in both sexes. *albipennis.*

*dorsata* Say.
*robertsoni* Fitch.
On the prairies, Illinois to Texas.

*marginata* Say.
*aurifera* Say.
*auletes* Germar.
*resh* Haldeman.
*bicostata* Walker.
New Jersey to Utah, and southward to Mexico.

*tibicen* Linn.
*opercularis* Olivier.
*pruinosa* Say.
*lyricen* DeGeer.
*canicularis* Harris.
All the United States east of the Rocky Mountains, and also southward to Brazil.

*superba* Fitch.
Arkansas, Indian Territory.

*albipennis* Say.
Arizona.

*Tettigia* Kol.

*hieroglyphica* Say.
*characteria* Germ.
*johannis* Walk.
*sexguttata* Walk.
New Jersey southward to Mexico.

*Proarna* Stål.

*championi* Distant.
Texas, Mexico.

*Tibicen* Latr.

*a.* Head much narrower than the thorax.

*b.* Expanse of wings 40 mm., markings yellow. *synodica.*

*bb.* Expanse of wings 60-70 mm., markings brown or brownish yellow. *rimosa.*

*aa.* Head nearly as wide as the pro-prothorax. *septendecim.*

*synodica* Say.
Illinois, Colorado.

*rimosa* Say.
*hesperina* Uhler.
*striatipes* Hald.
*noveboracensis* Emmons.
*occidentalis* Walker.
All the northern part of the United States, and in Canada.

*septendecim* Linn.
*cassinii* Fisher.
*tredecim* Riley.
Eastern part of U. S. as far north as New York and Michigan, and west to Colorado.

*Platypedia* Uhler.

*areolata* Uhler.
*putnami* Uhler.
Colorado to California.

*Melampsalta* Kol.

*parvula* Say
*pallescens* Germ.
Southern states, as far north as Ga., Ill. and Kansas.

# PSYCHE.

CAMBRIDGE, MASS., JUNE 1888.

*Communications, exchanges and editors' copies should be addressed to* Editors of Psyche, *Cambridge, Mass. Communications for publication in* Psyche *must be properly authenticated, and no anonymous articles will be published.*

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## PROCEEDINGS OF SOCIETIES.

### CAMBRIDGE ENTOMOLOGICAL CLUB.

(*Continued from p. 56.*)

14 May 1886.—The 120th meeting was held at 61 Sacramento St., Cambridge, 14 May 1886. In the absence of the president, Mr. P. S. Abbot was chosen chairman.

Mr. S: H. Scudder showed wood-cuts from Miall and Denny's work "The structure and life-history of the cockroach," and exhibited impressions from the different plates used in printing the plate of *pierinae* in his own work on New England butterflies. These impressions illustrated in a clear manner the process by which the figures are toned to their right color.

Mr. R. Hayward exhibited specimens of the species of *Nebria* collected by him in southwestern Colorado during the past summer (1885) and remarked briefly on their distribution and relative abundance. Among the species obtained were *N. ovipennis* (?), *N. purpurata*, *N. obliqua*, *N. trifaria* and others. The specimens referred to *N. ovipennis* were all found at altitudes above 10,000 ft. Many specimens of *N. purpurata* were obtained from under the bark of logs which had been washed down by a tributary of the Gunnison river.

Mr. F. S. Child showed two specimens of a species of *Cassida* from the cave of Elephantine, India.

Mr. G: Dimmock exhibited a case of some insect or spider, which had been found on a tree. It was made of grass and had a perfect lid.

11 June 1886.—The 121st meeting was held at the secretary's room, No. 36 Grays, Cambridge, 11 June 1886. In the absence of the president, Mr. S: H. Scudder was chosen chairman.

Messrs. S: H. Scudder and R. Hayward, remarked briefly on a collecting trip, which they had recently made to the White Mts., N. H.

Mr. S: H. Scudder stated that he was fairly confident of having seen *Chionobas semidea* near the summit of Mt. Washington. The species has not been previously noted earlier than the first week in July, and if the supposed specimens of *C. semidea* belonged in reality to that species, it would seem that there must be two broods in a season.

8 Oct. 1886.—The 122d meeting was held at 61 Sacramento St., Cambridge, 8 Oct. 1886. In the absence of the president, Dr. G: Dimmock was chosen chairman.

Mr. J. H. Emerton exhibited a figure of a male and female pink grasshopper (a variety *Amblycorypha oblongifolia*), which he had drawn for Mr. S: H. Scudder.

Mr. S: H. Scudder remarked at some length on this variety. The first recorded specimen of abnormally red locustarian was taken in the mountains of Pennsylvania, but belonged to a distinct species, *A. rotundifolia*. Four specimens of the red form of *A. oblongifolia* were taken during the past summer at Woods Holl, some of which were seen by Mr. Scudder while alive. They ate golden rod (*Solidago*) with avidity. Mr. Scudder has been looking up the bibliography of the subject, in hopes to remark further upon it at a subsequent meeting of the club. Brunner von Wattenwyl records a specimen from Pennsylvania with violet elytra, and also mentions a dimorphic form of

the neighboring genus *Scaphura* from Brazil. It has been suggested that since chlorophyll is found in certain insect tissues, the color might be changed by frost, but this could not have been possible in the Woods Holl specimens, as they were found too early in the season.

Mr. J. H. Emerton exhibited figures of the eggs of diurnal lepidoptera, which he had drawn for Mr. S: H. Scudder, a figure of the micropyle of a species of hesperid, and figures of the larvae of various butterflies.

Mr. S: H. Scudder showed a figure of the pupa of *Feniseca tarquinius* and remarked at some length on the habits of this interesting species. The chrysalis has a curiously expanded cremaster. The larva differs very much from those of other copper-butterflies with which it has been placed, by having large protruding legs and a scarcely retractile head, while in its earlier stage, according to Mr. W: H. Edwards, it is completely cylindrical, and in no way onisciform. The egg is not pitted, but only possesses polygonal marking.

Dr. G: Dimmock asked if there had been any study of the mouth-parts of the larva of *Feniseca*, with reference to any modification for its insect food.

Mr. J. H. Emerton exhibited a drawing of a wasp in the act of eating a fly. [See PSYCHE, May 1888, v. 5, p. 54.]

Mr. C: W. Woodworth stated that the only wasps that sleep with their mandibles grasping upon grass or sticks were males of *sphegidae*.

Mr. S: H. Scudder showed eggs of *Argynnis idalia*. Most of the eggs were laid upon the lace with which the butterflies had been covered during transportation, and not upon the violet leaves which had been placed with the butterflies. Some of the eggs were laid upon the lace while in the cars, the butterflies being in a dim light under a seat. All the eggs were pushed through by the ovipositor of the female so as to stand on the outside of the lace.

9 APRIL 1886.— The 119th meeting was held at 61 Sacramento St., 9 April 1886. In the absence of the president, Dr. G: Dimmock was chosen chairman.

The additions to the library were announced by the librarian.

The secretary stated that a reply had been sent to the invitation to attend a celebration of the fiftieth anniversary of the foundation of the Verein für naturkunde zu cassel.

Nominations nos. 136-142 were acted on and the following persons elected to Active membership: Prof. T: J. Burril, Champaign Ill: W: H. Garman, Champaign Ill: Clarence M. Weed, Champaign Ill: C: A. Hart, Champaign Ill: T: F. Hunt, Champaign Ill: Prof. C. Robertson, Carlinville, Ill: C: W: Woodworth, Champaign Ill.

Mr. S. H. Scudder spoke of a recent paper by Dr. Paul Oppenheim of Berlin upon fossil lepidoptera, in which new light was thrown upon some hitherto insufficiently known fossils from Solenhofen which had been referred to hemiptera, lepidoptera and hymenoptera. Dr. Oppenheim claimed, and apparently with some reason, that they should be referred to a distant archaic type to be considered the progenitors of lepidoptera. Two new Jurassic forms were described from Siberia which should probably be referred to the same archaic type, though looked upon by Oppenheim as true lepidoptera.

The Club then visited the laboratory of Dr. Dimmock, who showed his apparatus for rearing insects in constant increased temperature. He also showed some specimens of *Hippodamia convergens* which had been thus reared, and remarked on the difference in time of development and the variations caused by this artificial method of rearing. He further remarked on observations he had made as regards the time of appearance of the spots in various species of *coccinellidae*.

Prof. Alpheus Hyatt said that he had been much interested in Dr. Dimmock's experiments on the acceleration of development, as it has a close bearing on his own studies.

## ENTOMOLOGICAL ITEMS.

OMISSION.—Owing to the length of our leading articles the Bibliographical record will be omitted from this numero of PSYCHE.

MR. C: H: T. TOWNSEND has gone from the War department, Adjutant general's office, to the U. S. Department of agriculture, Washington, D. C., which is his present address.

PLATYPSYLLA SURELY COLEOPTEROUS.—Drs. G: H: Horn and C: V. Riley, working independently, have studied the larva of *Platypsylla castoris*, and state that the larval characters fully prove that the insect is coleopterous.

DR. G: H: HORN visits Europe again this season. The Doctor needs this recreation and we know he will bring back with him fresh energy that will enable him to continue his valuable work. His address will be: Care of Dr. D. Sharp, Shirley Warren, Southampton, England. The Doctor will leave May 9th and will be gone all summer.—*Entom. americana*, May 1888, v. 4, p. 36.

A CURIOUS MITE.—A species of *hydrachnidae*, found by Dr. Otto Zacharias in a little mountain stream, the Iser, in northern Germany, and known, on account of its large dermal glands, as *sperchon glandulosus*, has been found lately in the fresh waters of the Azores, by Prof. Barrois, of Lille, France. Dr. Zacharias calls attention, in the *Monateliche mittheilungen aus dem gesammtgebiet-der naturwissenschaften* (Dec. 1887, jahrg. 5, p. 215), to the curious fact that in both these distant localities this species is found only in such ponds and streams as have a temperature of 15-15.5° C.

ANT-INHABITED PLANTS.—Hernandez, about the middle of the seventeenth century, described the stipular thorns of *Acacia cornigera* of Central America, into which certain ants eat, feed upon the pulpy interior, and live in the dwelling thus made. Such inhabited thorns grow larger and distorted, and the ants seem to pay for their hospitality by protecting the tree from other marauding insects. Two woody *Rubiaceae* of Sumatra were described in 1750 by Rumphius, as inhabited by ants. They are both epiphytic and attached to the host tree by a large tuberous base, which is cavernous and occupied by ants. The ants, by their irritating presence, cause the tuberous growth to enlarge, but the enlargement begins during germination before the ants attack it—an instance of a plant preparing beforehand for expected guests. It is said that seedling plants which fail to become inhabited, perish. Dr. Gray, in a review, says that "it is most supposable that this extraordinary formation was acquired gradually; that the normally fleshy caulicle of the ancestral plant, made a nidus for an insect, developed under the disturbing stimulus somewhat as a gall develops, until at length, the tendency became hereditary, and the singular adaption of plant to insect was established."—*Botan. gazette.*

PHOTOGRAPHS OF COBWEBS. Mr. Horace P. Chandler of Boston has made a very successful photograph of an *Epeira* web by taking it early in the morning while it was covered with dew. A copy of this photograph is in the collection of the Boston Society of Natural History. The web hangs between the branches of a spruce tree and looks like that of *Epeira triaranea* though unfortunately the spider was not preserved for identification.

Amateur photographers can render good service by further experiments in this direction, taking care, each time, to preserve the spider in alcohol with a complete record of time, place and surrounding.

The following webs are good subjects for photography and often hang in convenient places: all the flat, round webs made by *Epeira* and its allies the web of *Linyphia marginata*, which consists of a flat dome three or four inches in diameter, held up by an irregular mass of web, extending upward

into the bushes sometimes a foot or more; also that of *L. communis* which consists of two sheets of web slightly curved downwards and supported in the same way by an irregular mass of web; several species of *Theridium* spin a web consisting of a little tent surrounded by irregular threads under branches of trees; the triangular web of *Hyptiotes cavatus* among the dead lower branches of pine trees; the small webs of *Dictyna* on the ends of dry weeds, and those of *Agalena naevia*, flat on grass with a tube leading out from one corner.

*James H: Emerton.*

FATAL SPIDER BITES.—The following is extracted from Mr. J: B. Smith's report of the meeting of the entomological society o Washington, for 1 March 1888, as given in *Entomologica americana* (May 1888, v. 4, p. 40):

"Prof C: V. Riley presented a paper entitled, 'A contribution to the literature of fatal spider bites,' giving details of a case in which death resulted from the bite of a spider, presumably *Latrodectes mactans*. Also details of another case in which the patient recovered from a bite of the same spider. Prof. Riley reviewed the literature of the subject at some length, and concludes that personal idiosyncacy is a large factor in these cases and that the poisonous secretion of spiders affected different individuals in a very different manner, and hence the discrepancy in results. Mr. Otto Lugger related an experience of his own with *Phydippus tripunctatus*, L., which bit one of his children. The result was convulsions, high fever, headache, swollen eyes and great pain in the pit of the bitten arm. In about three days all inflamation and untoward symptoms had disappeared. Dr. Marx states that the secretion in which *Latrodectes mactans* envelops its victims when taken internally had the effect of increasing the pulse from 72 to 120. He commented on the case, but rather skeptically: he cannot see how *Latrodectes*, with its minute, soft mandibles, can possibly pierce the skin or contain poison enough to produce the violent effects recorded."

VALUE OF PRIVATE COLLECTIONS. — At the end of some sensible remarks in answer to the question "What is the logical *raison d'être* of a collection of lepidoptera?" Mr. F. H. P. Coste, in an article entitled "On collections of lepidoptera" (Entomologist, Apr. 1887, v, 20, p. 93-96), adds:

"I should still advocate the collecting of insects by boys: their time is less valuable, and they find it a delightful amusement, and learn to know all our commoner insects, their haunts, and their classification; whilst, as they grow older, they slide gradually from collecting into scientific entomology. Herbert Spencer says: The practice of breeding larvae, 'when joined with the entomological collection, adds immense interest to Saturday afternoon rambles, and forms an admirable introduction to the study of physiology.'"

Mr. Coste rightly enough concludes that the collection and preservation of insects by so many individuals is a waste of time, from a scientific standpoint, and that much of the knowledge gained from maintaining a large private collection can be obtained as well by visits to a museum.

This abolition of his collection or confining it rigidly to some limited specialty or group of insects would leave the individual free to study particular subjects in entomology, and really to contribute to knowledge, instead of wasting time in pinning, setting and caring for a large collection, much of which is made up of a duplication of specimens found in abundance in museum collections. The application of the principles of division of labor in the work of the entomologist is becoming as important as it is in mechanical work, and the drudgery of preserving large collections ought to be left to museums, where it can be done better and at less real expense than by individual entomologists. *G: D.*

No. 145 was issued 11 May, 1888.

PSYCHE

A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 147—148.**

JULY—AUGUST 1888.

*CONTENTS:*



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

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*INDEX TO ENTOMOLOGICAL LITERATURE.*

Having accumulated an immense stock of references to the literature of entomology, I will furnish references on special subjects at ten cents each reference, or fifty cents per decade. For further particulars see PSYCHE for Oct.-Dec. 1884, v. 4, p. 223.

B: PICKMAN MANN,
Washington, D. C.

*LIBRARY OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.*

The librarian of the Cambridge Entomologica Club calls attention to the desirability of preserving in the library of the Club as complete a series of entomological publications as it is possible to collect. It is especially desirable to preserve the transient literature of the subject—separates, small pamphlets and newspaper articles—and the librarian will be pleased to receive single copies of the daily papers, scientific journals, magazines, or agricultural papers, which contain entomological articles. These papers are preserved and catalogd, and, because they are overlooked by large general libraries, are just the kind of material that should be preserved in a special entomological library. Any one who has sought for some of the best of the agricultural journals of the western states in libraries will appreciate any effort made to preserve journals of this sort.

Separates which are often thrown into the waste-basket, as useless, as too small for preservation, as duplications of parts of serials, or as valueless, are respectfully solicited. The friends of the Club are also asked to send a copy of newspapers in which they have published articles or notes on entomological subjects. If these notes are anonymous, the author's name will be acceptible information.

The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

Direct all papers for the library to

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Cambridge, Mass.

## ON THE GENUS CICADULA, ZETT.

BY CHARLES WILLIAM WOODWORTH, FAYETTEVILLE, ARK.

In the second part of Mr. James Edwards' excellent "Synopsis of British Homoptera" (Trans. Ent. Soc. Lond., 1888, pp. 13-108, pl. 3) it will be seen that the old genus *Cicadula* has been entirely suppressed as it seems without due consideration.

Zetterstedt in his "Insecta Lapponica" (1840) divided the *jassidae* of that region into four genera as follows; *Jassus* corresponding exactly with Mr. Edwards' family *bythoscopidae*, *Cicada* equivalent to *Deltocephalus* of later authors, *Thamnotettix* including the species now placed in the two genera *Thamnotettix* and *Athysanus* and *Cicadula* which corresponds to *Limnotettix*, *Gnathodus* and the *typhlocybini*.

*Cicadula* was originally divided by Zetterstedt into eight sections which correspond to modern genera as follows:

a. = Limnotettix.
b. = Kybos.
c. = Gnathodus.
d. = Alebra and Dicroneura.
e. f. h. = Eupteryx.
g. = Typhlocyba.

The separation of the *jassini* from the *typhlocybini* was, naturally, the first act of subsequent authors, accordingly Boheman (Nya Sven. Homop. 1845) restricted the *jassini* to *Thamnotettix* and called the rest *Typhlocyba*. In the same way did Flor (Die Rhynch. Livl. 1861) and Kirschbaum (Cicadinen Gegend Wiesbaden 1868) but they substituted *Jassus* for *Thamnotettix*. Marshall (Ent. Mo. Mag. v. 3, 1866) divided them in a similar way but he preferred the name *Eupteryx* Curtis to *Typhlocyba* Germ., and the former really had priority. In 1866 Stål (Hemip. Africana, pt. 4, p. 119) pointed out that *Jassus* was not applicable for European species so it became necessary to make some other disposition for them.

This was an opportune time for the dismemberment of the old polymorphous groups and the formation of more restricted genera, accordingly Fieber undertook this task and in 1866 his "Neue Gattungen und Arten in Homoptera" appeared. In this work the characters used for the separation of the genera were often insufficient so that many more genera were formed than the facts allowed. Fieber himself soon recognized this and in later works (Katalog Cicadinen 1872 and Cicadines d' Europe 1876) tried to rectify, as far as possible, his mistakes. He believed that *Cicadula* should be used for a genus of Jassids, and not of *Typhlocybids*, so he made it one of the four genera into which he divided this portion of the old genus *Jassus*. Two of these genera he made synonyms in a later work but here

he made the mistake of placing one species in *Thamnotettix;* with this exception Fieber places all the species of the old genus *Cicadula* in *Cicadula*, *Gnathodus* and the various genera of the *typhlocybini*.

In 1871 J. Sahlberg (Not. Fen.) differs from Fieber in this assignment of the genus *Cicadula* and apparently because the larger number of the species of Zetterstedt's genus were *typhlocybini* he thought that the restricted genus *Cicadula* should be of that group, so he chose the first species belonging to it as the type, thus sinking Fieber's genus *Kybos*—a proceeding entirely unwarranted and at variance with all rules of nomenclature. Not only did he do this but he also erected a new genus for the true Jassids, notwithstanding that at least two of Fieber's genera had priority over it.

The English hemipterologists, Douglass and Scott (Ent. Mo. Mag. v. 11), and Edwards never countenanced the suppression of *Kybos* but have failed to notice the manner in which Sahlberg substituted his own name *Limnotettix* for the time honored *Cicadula*.

I hold, therefore, that *Cicadula* is the proper name of the genus now called *Limnotettix* and that *quadrinotata* Fabr., must be considered its type.

The following is, I think, the correct assignment of Zetterstedt's species.

| | | | | | |
|---|---|---|---|---|---|
| a. | 1. | quadrinotata Fabr. | = | Cicadula | quadrinotata Fabr. |
| | 2. | strigipes Zett. | = | | quadrinotata Fabr. |
| | 3. | maculipes Zett. | = | | quadripunctata Fall. |
| | 4. | sexnotata Fll. | = | | sexnotata Fall. |
| | 5. | alpina Zett. | = | | sexnotata Fall. |
| | 6. | septemnotata Fall. | = | | septemnotata Fall. |
| | 7. | dahlborni Zett. | = | | dahlborni Zett. |
| | 8. | sulphurella Zett. | = | | sulphurella Zett. |
| b. | 9. | smaragdula Fall. | = | Kybos | smaragdula Fall. |
| c. | 10 | punctata Thunb. | = | Gnathnodus | punctatus Thunb. |
| | 11. | spreta Zett. | = | | punctatus Thunb. |
| d. | 12. | elegantula Dahlb. | = | Alebra | albostriella Fall. |
| | 13. | citrinella Zett. | = | Dicroneura | citrinella Zett. |
| | 14. | gracilis Zett. | = | | citrinella Zett. |
| | 15. | micantulus Zett. | = | | micantulus Zett. |
| e. | 16. | utricae Fabr. | = | Eupteryx | utricae Fabr. |
| f. | 17. | vittata Linn. | = | | vittata Linn. |
| g. | 18. | rosae Linn. | = | Typhlocyba | rosae Linn. |
| | 19. | lineatella Fall. | = | | geometrica Schrank. |
| | 20. | sexpunctata Fall. | = | | sexpunctata Fall. |
| | 21. | 10-punctata Fall. | = | | sexpunctata Fall. |
| h. | 22. | pulchella Fall. | = | Eupteryx | pulchella Fall. |
| | 23. | germari Zett. | = | | germari Zett. |

# THE STUDY OF SPECIES AND THE STUDY OF CELLS.

BY JAMES HENRY EMERTON, BOSTON, MASS.

[Annual address of the retiring president of the Cambridge Entomological Club, 13 January 1888.]

During the last few years the study of species has become less and less fashionable among naturalists. New species are still described and old ones better defined. The changes which animals pass through as they grow up are better understood and their habits and distribution better known and explained but all this work is carried on in the face of the opinion of a large body of our most active naturalists that it is not the most proper kind of work for a naturalist to do and might as well be left undone. For this reason many students have felt that they could make no investigations of any value without a laboratory and complicated apparatus of the latest kind and others who have begun valuable sysetmatic studies have felt called upon to waste what they had done and begin again a new kind of study.

This state of things is of special interest to entomologists. The great number of species of insects makes it important that there should always be men who make it their special work to know the species of large groups and who are able to make use of new discoveries in improving their classification and any prejudice that prevents the best young naturalists from beginning early the study of species and getting the knowledge and practice it needs, is one that entomologists above all others should do their best to discourage.

It is hard for us to realize that twenty-five or thirty years ago most naturalists believed that species could not be explained and were for all practical purposes the bottom facts of natural history. The sudden change of opinion on this subject has naturally led to a comparative neglect of the study of species.

At the same time the improvements of microscopes and improved methods of dissection by which each cell in an animal can be separately examined have opened a new field of study which has drawn attention away from older ones.

A student beginning his studies naturally follows that line which is most popular or most novel at the time. He sees the latest books filled with discoveries in that direction, his teachers are helping to make those discoveries and he sees in doing the same thing the best prospect of success in his profession.

I would not undervalue in any way the microscopic anatomical work now so popular with students, but only the prejudice which leads them to believe that it is something different from and superior to the study and classification of whole animals.

The study of species has for its object to improve their classification, that is to measure their resemblances and

differences and in this way try to explain why they differ from each other and why some kinds exist instead of others that might have existed.

The study of microscopic anatomy attempts the same thing with smaller objects. It compares cells together and classifies them into layers and tissues and so tries to explain the cause of their differences and why they combine together some into one organ and some into another.

In the study of species there is use for all the facts that can be found. It is true our classifications of most animals is based on a very superficial knowledge of them but this is because the number of animals is so great that there has not been time to know more. There is no prospect of everything being known about any one animal and our classifications and theories must be made to suit the facts as they are and then improved as knowledge increases.

It has often been urged against the study of species that is largely a study of names, and students have turned to histology or embryology hoping to avoid this and accomplish more with the same labor. This may have been possible once but any embryological or histological book of the present time has as large a part devoted to the meanings of words and interpretations of the descriptions of other writers on the same subject as any book on classification, nor is there any reason to believe that the proportion of space thus devoted to synonymy will decrease.

The classification of species is largely based on specimens which are kept in museums more or less public and it is often possible for persons interested to compare them with what has been written about them and the importance of preserving such type specimens is generally recognized.

The type specimens of microscopic studies are generally kept by individual students and are small and easily destroyed so that the facilities for comparison are small.

Thus the mistakes of systematic natural history are more easily seen and the difference between good and bad work understood by a large number of persons while the mistakes of microscopic observations are hard to find and so supposed to be rare.

The students of the present day can therefore go on describing new cells with the same freedom with which those of the past generation described species leaving to those that come after them to correct and explain what they have written. With increase in the number of students this advantage is passing away and the histologist will soon have to spend as much labor in identifying what he finds as the student of species.

When the attractions of a new study are gone we shall see that, except in the size of the object studied these two lines of work differ but little and one is as likely to gather valuable facts and new theories as the other and that in either field the value of the work depends only on the care and skill with which it is done.

# THE MEANS EMPLOYED BY BUTTERFLIES OF THE GENUS BASILARCHIA FOR THE PERPETUATION OF THE SPECIES.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

The power of reproduction conceded, the universal instinct for self-preservation is the fundamental and controlling principle by which the perpetuation of any kind of animal is successfully reached. The uncontrollable maternal instinct of self-sacrifice existing in some animals alone overmasters it, and this exists only in the higher animals, which, compared with the great mass, are but few in number; and is then in most cases called into play only when the creature's life-work is nearly finished. No such instinct occurs among butterflies, nor is in any way likely to be found, so that "self-preservation" and "perpetuation of the species" are here, at least through all but the closing days of life, practically equivalent terms. The "struggle for existence" in the species and in the individual are largely convertible terms.

This struggle is the perpetual inheritance of the individual. The individual inherits alike its structure and its habits of life, which latter are very largely, perhaps almost absolutely, dependent on its structure; its tastes and its propensities, its fears and its devices to circumvent its enemies; all its instincts, which are to a great extent, possibly wholly, the entailment of ancestral habits; its very attitudes, whether at rest or in motion. Its advantages and its disadvantages are thus alike its legacy; so too the peculiar means it employs to disembarrass itself of these disadvantages. This is especially and more immediately true of the insect in its earlier stages, where freedom to change the immediate surroundings is exceedingly limited or altogether impossible, except so far as there is foresight, or an instinct marvellously akin to foresight on the part of the creature in an antecedent stage.

It is of more than usual interest to study the means of self-preservation in the genus *Basilarchia*, since there is hardly another genus of butterflies where throughout its entire life the insect is apparently so exposed to its enemies. They are all, of their kind, conspicuous objects even to our dull eyes, and more than that they are, with the exception of the chrysalis, always found in unusually conspicuous situations. How then do they manage to escape their keen sighted foes, the birds, or their wakeful, indefatigable, persistent enemies among the insect tribes,—ichneumons, ants, wasps, flies, mites, and spiders?

Take first the egg-stage. Every one who has attempted to rear butterflies knows what immense destruction falls to the lot of any species at this stage in its life. Ants and spiders look on them as delicacies made for their delectation, and there is a whole group of tiny

*hymenoptera*, almost too small to breathe, one would think, mere specks, which live solely upon insects' eggs, piercing them with their egg-darts, their progeny living imprisoned and feeding on the contents until they have run the cycle of their changes. Some attack whole batches of eggs, laying one egg in each, so that one parasite may destroy the entire brood of one butterfly; others lay their all in one or two eggs, and it is to this class that those belong which sting the eggs of *Basilarchia*. How does *Basilarchia* escape this danger? In the first place, the mother rarely lays more than one egg in one spot or even on one bush, though as many as a dozen or two may occasionally be found, where the butterfly's numbers are great and they are growing as it were imprudent. Then it must be remembered first that—to judge from the latest researches—these parasitic flies must be guided less by vision than by touch; and second, that most insect eggs are laid on the broader parts of the leaf on which the young will feed; it is here that the parasite will range in quest of prey; but the eggs of *Basilarchia* are rarely found except at the extreme tips of leaves, and in addition the leaves of the food-plants concerned are all acuminate, some to an excessive extent, as in some of the poplars and birches. When the parasite has, however, found an egg, it may well be inquired whether she would not be deceived by it. It differs from the eggs of all our other butterflies, in that it is besprinkled with little flexible filaments for all the world like the hairs of some leaves. Or if the clothing of the eggs did not deceive, she might even then find it difficult of attack, for minute as these parasites are, less than half a millimetre long, their bodies would extend across at least three of the polygonal cells which regularly stud the surface of the egg, and which send forth these little filaments at every angle, so that poor bewildered madame must struggle through a weary chapparal before she can attain the barren grounds at the summit and find a spot to readily insert her sting. Yet that she succeeds is only too evident to the collector; the larger part of the eggs obtained in the open field which have fallen into my hands have been parasitized.

This is its but too partial defence against its special enemies. But how about those wandering buccaneers, the ants, mites, and spiders? These labor under the same visual defects as the direct parasites, or sometimes greater ones, and the position of the egg, remote from their usual hunting ground, must serve as no inconsiderable protection; how great, there are hardly means of measurement. Their greatest protection from these savages, which cannot fly but must wander ceaselessly about on foot in search of prey with satanic energy, is undoubtedly in the fewness of their number on one plant. The spider that finds two eggs of a *Basilarchia* in one day must be an excellent hunter.

Escaped at last from these dangers,

which only lasted at the most ten days the caterpillar crawls forth from its prison and begins its active life. It is a scrawny juiceless looking thing, all covered with warts, and less than any other newly born caterpillar, would seem a tempting morsel even to an ichneumon or a spider. Yet both make havoc with it at this time. To a wandering ichneumon contact with an empty egg-shell would probably mean, as a result of its inherited wisdom, that some nice young caterpillar was about, and the neighborhood would be all the more thoroughly ransacked. Caterpillars devouring their egg-shells, and so not leaving this "scent" behind them, would oftenest escape, and by degrees this habit would be perpetuated and fixed; and so it is here; almost invariably the caterpillar hastens to destroy its former prison walls, which it devours to the very base, too closely glued to the leaf to be eaten; probably it breathes more freely when that is done.

But where does it now find itself? Its food at its very feet,—yes; but in the most exposed position possible. Atop the extreme tip of one of the outmost leaves of a spray that projects most freely into the sun and air, just where it can most easily be seen by the passer by; this seems to be the case nine times out of ten. It is, however, probably the safest place from the prowling spiders; but surely not from its flying enemies. What does it do? retreat down the leaf? That would be only to exchange one danger for another, and on its way to a presumed place of safety it would be more sure of detection, because a moving object in nature is alway most easily noticed. No, it eats the nearest bit of leaf down to but not including the midrib, first on one side and then on the other, and then retires to near the tip of the midrib to digest it; subsequent meals it takes in the same way, moving with excessive deliberation along its narrow path and retiring always to the same spot. On this perch it cannot be seen from below, and from the sides and above seems almost or wholly a part of the denuded midrib to which it clings; more particularly when the leaves are in motion by the wind, as they usually are on the trees on which it feeds, particularly in the case of the aspen.

That this mode of life is on the whole an advantage to it is rendered probable from the fact that there are two cases known, in which it is followed very closely by caterpillars of a moth (*Notodonta*), feeding on the very same plant as species of butterflies with this habit (one in Europe and one in America); while the caterpillars of *Basilarchia* employ a further device, the actual import of which has been a puzzle. Very soon after birth, when it has eaten but a very few swaths down the leaf, the little fellow constructs a small and loose packet from minute bits of leaf and other rejectamenta, loosely fastened to one another and to the midrib, close to but scarcely touching the eaten edge of the leaf, and as fast as the leaf is eaten, it removes this packet (continually added to until it becomes about as big as a

small pea), farther and farther down the midrib away from its perch, always keeping it near the eaten edge. It should be noted that it is so loosely attached, the bits of leaf at all possible angles, that it is moved by the least breath. Meanwhile the caterpillar has been growing larger and more conspicuous and thus in greater peril from its enemies. There are two possible services that this odd packet may render. A spider wandering over the leaf and observing its motion may seize it and thinking it has a prize hurry away with it and leave its architect unharmed. This seems to me rather a strained suggestion, for a wandering spider would probably proceed to investigate it on the spot. Another explanation seems more probable. It should be remembered that the leaves preferred by these creatures as food are mostly such as are easily shaken by the wind, and as the caterpillar moves with the leaf and with all the surrounding leaves, in a continual fluttering in the case of the trembling aspen, and to a less degree in the other food-plants, this of itself is a protection to it, as it would more readily escape observation as an object distinct from the leaves, all being in motion together; but on the more stable leaves like the willow and especially the *Rosaceae* and the oaks, the motion in a feeble wind would not be sufficient to be serviceable, and here at least the packet comes into play. An object in motion among others at rest is a most noticeable thing, a fact well recognized among animals, as a host of them show when they fear being seen. This packet attached by loose silken threads moves, as stated, with a breath of wind and so would distract attention from its architect near by, who has taken pains to place it at the farthest remove from its perch, while still (to avoid undesirable steps) on its daily track. If this be really its object, it is surely one of the oddest devices in nature.

The species of *Basilarchia* all pass the winter while in the caterpillar state and but partly grown. The caterpillar has moulted at least once (devouring its cast-off clothing, by the way, doubtless that it may not attract attention) and has to prepare against the inclement season. This it does in a very shrewd way, which is all the more remarkable because no trace or semblance of it is seen in caterpillars of the broods that attain their entire growth in the same season. When the proper time approaches, warned thereto possibly by the dryness of its food, or by the cooler nights, the caterpillar constructs a little nest, sometimes from the still unfinished leaf on which it was born, sometimes from one which it prepares specially at greater pains; this is done by eating away or biting off the unnecessary parts, and leaving on either side of the base of the leaf little flaps just large enough, when drawn together, bottom side up and meeting above, to form a cylinder into which it can squeeze; a projecting shelf is also left beyond the opening, on which it may stand when ready to crawl in, and upon which it may back out in the spring; the whole

of the inside and the upper surface of the shelf are then plastered over with a dense coating of brown silk and the flaps drawn together; more than that, with strangest foresight. the petiole of the leaf is thoroughly fastened to the stem by numberless threads passed carefully and tightly around both; into this cylinder it then crawls head foremost, completely filling the cavity, closing the bevelled hinder opening with the sloping tuberculate and sharpened terminal segments, sure to find itself there when the long night of winter is passed. No, not quite sure, for wasps or some other strong predaceous insects will tear this fine castle open and destroy its single occupant. Whether it is an additional safeguard or not, it is an instructive fact that, at least where the winters are most severe, nearly all these hibernacula are made out of leaves so near the ground that the snow covers them with its warming mantle; and what is more, in certain cases they so closely resemble the winter buds and bursting leaves of the new year that they must sometimes deceive their prowling foes of the early spring.

Shortly after it appears again in the spring and has fed on the tender buds and just opening leaves, it moults again, usually upon the shelf of its hibernaculum but no longer devours its skin, as it quits the immediate neighborhood. It now changes its livery as well and is a most extraordinary looking object, withal very conspicuous. Dark and light green and cream color strive for the mastery and leave it streaked and blotched so that it bears no inconsiderable resemblance, in color at least, to the droppings of some birds, a circumstance which doubtless serves it as some sort of protection. Its body is humped and the bosses bear tubercles which give it a somewhat repulsive aspect; especially a pair a little behind the head are raised aloft thickly studded with prominences, the effect of which is heightened by the creature's habit of arching this part of the body. bending its head to the ground and raising aloft its hinder part. also studded with roughened processes. Altogether it is a rather hideous beast. Then too, if disturbed, it raises the front half of its body from the ground and uses it as a kind of whip-lash throwing it to one side and the other with great violence. When it walks it moves with a slow and cautious tread, its head trembling as if it had the palsy. All this is doubtless to inspire fear to such enemies as might be tempted to attack it. but to how much avail we can hardly tell. It is certainly attacked in considerable numbers by a parasitic hymenopteron, the young of which live within on the juices of the body and escape from the chrysalis when that is formed.

The chrysalis, helpless thing, probably hangs quite exposed upon the stem of the plant which has given the caterpillar nourishment. We know it almost entirely from those raised in confinement. It has an oddly shaped form with a great projection on the back like a Roman nose, and is of a dark green or greenish brown color varied with

cream color, and smooth as if varnished. This makes it appear like a hanging lump of bird dung, and so again must often prevent its being picked off and devoured by some hungry bird.

When one that has at last escaped all the perils of its youth finally reaches its full development, it is even more conspicuous and exposed than before. Although now upon the wing and no doubt often able to escape a pursuer by some quick movement, its natural flight is not swift, and its ordinary movements on the wing are a few quick flutters followed by a sailing motion which is most favorable to capture. Its colors differ of course in the different kinds, and they may in this particular be divided into two classes. One affects a deep rich black-blue or blackish purple, and is variegated with light blue and white, the latter partly in the form of bands, on some forming a broad bow across both wings, rendering them most conspicuous and striking objects. They are, too, of a pretty large size, and as they fly mostly in the neighborhood of copses or along shaded roadsides or forest roads, they seem to render themselves by the contrasting back-ground as conspicuous as possible. Another class is of an orange brown color of greater or less depth, while the veins are black, and a black stripe, sometimes accompanied by white dots, crosses the wings. These fly in more open places, more fully exposed to the sun and are scarcely less conspicuous than their fellows. All these butterflies live a considerable time, and indeed the eggs do not mature in the bodies of the females until they have been a fortnight on the wing; and then they do not lay all their eggs at once, or even within a few days, but prolong the operation over many days or even several weeks. To deposit all her eggs therefore, which is the province of course of the female, she must fly amid all the dangers her conspicuous colors offer for about a month, a considerably longer time than the average of butterflies. Previous to egg-laying at least, much of her time is spent upon the ground in company with her fellows, often in great flocks, engrossed in sucking up moisture from the damp earth, from decaying fruits or the droppings of beasts; and so must become a conspicuous and easy prey to her enemies.

What then is to become of this saving remnant of the tribe? How escape from the dangers which it seems to invite? For the individual there would seem to be nothing but chance; but the number of eggs laid under the most favorable circumstances or chances is very considerable; and if only a pair of these finally reaches maturity and is able to fulfil its functions, the number of individuals of the species is maintained. It would seem, however, as if even this chance were small and as if still further protection were needed. And one further protection is afforded, at least to the orange species, in a peculiarity of their life history. Apparently the species of *Basilarchia* are, at least in New England, normally single brooded; but in not infrequent cases, doubtless

more frequent in southern than in northern parts, a second or supplementary brood is formed in one season; as the butterfly lays eggs for some time, and all the females are not born at once, the earliest progeny of the earliest females may not infrequently be able to mature in the same season in time for the production of a second brood. This would seem to be a provision on the part of nature to give the species a better chance. That they need it is perhaps evidenced by the fact that the black-veined orange species, which are almost universally more numerous in individuals than the others, have, in regions where one brood is the normal condition of their fellows, always two broods.

But this is not the only advantage the black-veined orange species have, so that we cannot fairly ascribe their greater numbers to this alone. Their very colors are an advantage to them, for in them they mimic species of *Euploeinae*, which possess a taste and perhaps an odor offensive to birds and other insectivorous animals; the mimicry is very striking indeed, and is the more remarkable from the fact that the northern species resembles the only species of *Euploeinae* found in the region it inhabits, while the southern species as well as the southernmost examples of the northern species, resemble another which is more common in the region they inhabit.

It is indeed possible that one of the normally colored species of *Basilarchia*, one that has least conspicuously contrasted colors, though resplendent with blue and green, is specially protected by the various other devices we have recounted; for certainly it is itself mimicked by one sex of a butterfly of another very distinct group, viz: *Semnopsyche diana*.

## DESCRIPTION OF THE LARVA OF SPHINX LUSCITIOSA.

BY CAROLINE G. SOULE, BROOKLINE, MASS.

This larva was found on a poplar shoot, at Sugar Hill, N. H., 21 July 1887.

It was then 18.5 mm. long, slender, and green. The head was triangular, pale green, with a pale yellow stripe on each side. The body was brighter green, covered with white granulations, these being less numerous ventrally.

There were seven oblique lines of pale yellow, edged above with green darker than the body, and the last one extended to the tip of the caudal horn. A clear yellow horizontal line on the first three segments, was continued *very faintly* to the last segment.

The anal shield was of a bluer green than the body, and edged with white.

The feet and props were green; the caudal horn was pinkish above, green beneath, and lined on each side with yellow. Spiracles almost invisible.

The larva moulted on 25 July, and was 25 mm. long and of the same colors and marks as before.

On 27 July faint lines of a reddish color began to appear above the oblique yellow lines.

On 30 July the larva was 44 mm. long, and ate voraciously. The tips of the feet had become red. The yellow stripes on the head had grown very bright.

On 31 July it moulted again, being 53 mm. long.

The mouth parts were black; the yellow face-lines were edged with black; and the caudal horn had a black line on each side instead of a yellow line. Other marks as before.

On 2 August the colors had changed somewhat.

The face-lines had become pale green edged with black — rather faint —; the seven obliques were white edged above with pinkish lilac; the yellow horizontal line had gone from the first three segments, and those segments, as well as the lower half of all the others, were marked with tiny white dots, each encircled with black.

The props had a faint purplish tinge. The spiracles were red.

The head had grown more round, with a slight indentation on top — not enough to call the head bifid.

On 4 August the larva was 62.5 mm. long, and the marks were brighter. The caudal horn was short in proportion to the size of the caterpillar.

On 10 August the length of the larva was 87.5. mm., and the marks were unchanged.

On 12 August it began to be restless, and on 13 August it went into the ground during the night, but re-appeared again on the 14th, though it ate nothing.

On 15 August it had gone into the ground again, and 21 August it had become a bright mahogany-colored pupa, 37.5 mm. long, with a tongue-case 3 mm. in length and lying close against the pupa.

On 7 June, 1888, the pupa had grown much darker and duller, and on 10 June, at about 8.30 A.M., a fine ♀ emerged.

The larva was fed entirely on poplar.

I had netted a ♂ imago in a field near the poplar where I found this larva, only a few days before, flying at almost noon, and feeding at kale blossoms.

## THE ARRANGEMENT OF THE NEW ENGLAND SPECIES OF THANAOS.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

An examination of the androconia concealed in the costal fold of the fore wing in the species of this genus has brought to light some very curious facts, showing how closely related, as far as these scales are concerned, some of the

species are to each other and how very distinct some that were supposed to be doubtfully separable. This has led to some further examination of the eccentric abdominal appendages of the males, and to a new arrangement of the groups proposed by Mr. Burgess and myself (Proc. Bost. Soc. Nat. Hist., v. 13, p. 282-306, pl.) when we first described these organs. The following table brings out the more striking features and arranges the New England species in a more logical order than before. Ausonius, a somewhat anomalous species, is included in the list as found upon the confines of New England. The only known specimen having been only partially examined (Mr. Lintner kindly permitted me to remove enough scales to study the more prominent characteristics), such features as it is only presumed to have in common with its nearest ally, are placed in brackets.

*A*. With subapical white spots on fore wings. Terminal hooks of upper organ of ♂ genitalia separate; blades of clasps very long, especially on left side, when compared to the main body. Costal fold furnished with long pediform bristles, curving at base, but with no thread-tipped tapering scales, or apple-seed shaped scales, or twisted ribbons.

I. Species of smaller size. Upper organ of ♂ genitalia without a crest; tooth of same reduced to a bristle; basal process of left clasp unarmed; the blade very slender. Costal fold with many long rod-shaped scales ending in two minute points.

*a*. Processes of left clasp of ♂ genitalia almost as slender as the blade. The smaller boat-shaped scales of the costal fold often no more than twice as long as broad.....*lucilius*.

*b*. Processes of left clasp much broader than the blade. The smaller boat-shaped androconia rarely or never so short as above........................................*persius*.

II. Species of larger size. Upper organ with a distinct prickly crest; tooth well developed; basal process of left clasp armed with spinules; the blade moderately slender. Costal fold with no 2-pronged rod-like scales and the different species of this group show no distinction in androconia.

*a*. Crest of upper organ of ♂ genitalia slightly elevated and bearing a vertical shield expanding apically; lobe of right clasp dactylate, curving inward..................*juvenalis*.

*b*. Crest strongly elevated and surmounted by a horse-shoe shaped ridge; lobe of right clasp greatly expanded, broadest apically.......................................*horatius*.

*c*. Crest forming a gibbous prickly protuberance; lobe of right clasp greatly expanded, broadest basally...........*terentius*.

*B*. With or without subapical spots. [Terminal hooks of upper organ separate]; blade of clasps moderately long as compared to the main body. [Costal fold furnished with long pediform bristles, curving at base, and apple-seed shaped scales, but with no thread-tipped tapering scales nor twisted ribbons].[1]

*a*. With subapical spots. Right clasp with a slightly prominent median denticle; beyond the bend moderately produced.......................................*martialis*.

*b*. Without subapical spots. Right clasp with a somewhat prominent median denticle; beyond the bend much produced.......................................*ausonius*.

*C*. No subapical spots. Terminal hooks of upper organ consolidated and stout; blades of clasps very short when compared with the main body. Costal fold furnished with thread-tipped tapering scales or twisted ribbons, but with no long pediform bristles, or apple-seed like scales, or 2-pronged rod-like scales.

*a*. Of moderate size. Blade of right clasp stout. Costal fold with twisted ribbon-like scales...........................*brizo*.

*b*. Of small size. Blade of right clasp slender. Costal fold with thread-tipped tapering scales...........................*icelus*.

## THE USE OF TWO DOORS IN A TRAP-DOOR SPIDER'S NEST.

BY GEORGE F. ATKINSON, COLUMBIA, S. C.

Certain of the species of *Nemesia*, the habits of which Mr. Moggridge studied, make two trap-doors to their nests, one at the surface of ground at the upper end of the main tube, the other a short distance below at the beginning of a branch tube. Mr. Moggridge supposed the use of the branch and second door was to afford the spider a means of escape when pursued by an enemy. When chased into the main tube, the spider would go into the branch and close the

door; the enemy following, and finding the main tube empty, would leave.* In my studies of the nests and food habits of *Myrmekiaphila foliata*,† I found indications that the main tube was constructed to serve as a gallery for the passage of ants, or other insects, and that the branch was constructed as a real trap, in which the spider awaited the passing of an ant, when it would open the door and catch the insect. The arguments I then advanced, briefly stated, are: 1st, the nests then found were all made in places where ants had underground passages, 2nd, the main tube connected with some of the ant's galleries, 3rd, the trap-door at the surface of the ground had the appearance of being little used, and 4th, one nest had only one door leading into a short tube. This tube opened into the floor of a broad hall of the ant's nest leading into several galleries. Near this broad hall was the opening to the surface of the ground, made by the ants, and through which the spider probably entered the hall to construct her "branch tube" in the floor.

In May 1888, at Chapel Hill, N. C. I found a nest of *Myrmekiaphila foliata*, under conditions which seem to give conclusive evidence that the main tube is intended to entrap unwary insects that they might be "gobbled in" as they pass the door of the branch where the spider remains. The nest was made in a broad foot path, where the clay soil was very hard. I discovered it by seeing the open door. The following day I visited the place with trowel in hand to dig up the spider. I found the door still open. The main tube was about nine inches long, the branch about one inch long and was situated six inches from the surface of the ground. In this I found the spider. The door to the branch was a *cork* door, while that at the surface of the ground was a *wafer* door. It appears in cases where the nest is not made in an ant's nest, that the outer door is set open, thus offering an attractive place for insects that are crawling on the surface of the ground in search of food. They enter the main tube, and as they pass the branch, the door is suddenly thrown open, and to their surprise they are taken captive and made a meal of by the cunning spider.

* Harvesting Ants and Trap-Door spiders.

† Entomological Americana, Oct. & Nov. 1886.

## MATING OF SAMIA CYNTHIA IN CAPTIVITY.

BY CAROLINE G. SOULE, BROOKLINE, MASS.

Last winter I received from Nantucket cocoons of *Samia cynthia* and on the 8th of May, 1888, at 11-30 A. M., a ♂ and ♀ emerged and crawled up the side of my pupa-box at the same time. I removed them to a cage to see if they would mate in captivity.

My cage consists of a shallow flower-pot, seven inches in diameter and nearly full of sand; a circle of heavy cop-

per wire six inches in diameter, to which are attached four movable uprights of the same wire; and a piece of netting.

When set the uprights are stuck into the sand at equal distances, supporting the copper ring at about six inches from the top of the flower pot. The netting is spread over this frame and held to the flower-pot by a rubber band, making an airy cage, the top of which is flat, enabling the moths to hang from it. This cage I put on a table in a room with one window partly open.

The two moths were very quiet all the next day, 9th May, but on the 10th the male crawled about the netting, without seeming to notice the female, who was still quiet, only opening and shutting her wings now and then. I set the cage so that the female was nearest the open window but more than ten feet away from it. Soon after nine in the evening the male began to seem excited and to vibrate his wings so fast that they made a dull buzzing sound, loud enough to attract my attention at the far end of the room. I kept a light until eleven o'clock and all the time the male either kept up the buzzing vibration, or crawled over the netting near the female, opening and shutting his wings as if to display them. As soon as the light was out I heard a great fluttering, which stopped before half-past eleven.

The next morning the moths were *in coitu* hanging from the top of the cage, and so remained until 6.30 P. M., when they separated, and for about an hour were very quiet.

I then put the female into a box covered with netting and before 10 P. M. she had laid 159 eggs.

| | | | | | |
|---|---|---|---|---|---|
| 11th | May | she | laid | 80 | eggs. |
| 12th | " | " | " | 40 | " |
| 13th | " | " | " | 21 | " |
| 14th | " | " | " | 13 | " |
| 15th | " | " | " | 10 | " |
| 16th | " | " | " | 6 | " |
| 17th | " | " | " | 6 | " |
| 18th | " | " | " | 6 | " |

making a total of 341 eggs.

The last eggs were pure white, without the dark spots characteristic of the others. All the eggs were laid before midnight and most of them before 10 P. M. On 19th of May the female died, the male I had let fly on the third day.

Both emitted a rank odor, not unlike that of *Ailanthus*-flowers and I could not perceive that the odor of the female was stronger or different from that of the male though I tested them in sepaate rooms.

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INSECT LIFE. Under this title the United States Entomologist begins the publication of a periodical bulletin to be issued on an average once a month. It will contain brief notes and papers which are not adapted for the annual reports or the special bulletins of the Division. The first numero is dated July 1888 and contains among other interesting matter a complete life-history of the Willow-shoot Saw-fly (*Phylloecus integer*). Dr. Williston describes and figures *Lestophornus iceryae* a new genus and species of *Oscinidae* parasitic on the fluted scale (*Icerya purchasi*).

## BIBLIOGRAPHICAL RECORD.

*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name, as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic; G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

**Adye,** J. M. Favourable nights for sugaring, (Entomologist, Mar. 1887, v. 20, p. 66.)

Recommends sugaring in a gale of wind, as he has been most successful on such stormy evenings. *G: D.* (4503)

**Barret,** C: Golding. *Tinea granella* at King's Lynn [Norfolk, England]. (Entom. mo. mag., Feb. 1888, v. 24, p. 212-213.)

Mode of pupation and other habits of *tinea granella;* brief description of its larva. *G: D.* (4504)

**Bath,** W. Harcourt. Relaxing insects. (Entomologist, Feb. 1888, v. 21, p. 65-66.)

Mode of using benzine and arsenic in connection with moist sand in relaxing insects for setting. *G: D.* (4505)

**Bergé,** Albert. Résumé d'une note de M. le Dr. Hagen sur l'emploi des bouchons de caoutchouc vulcanisé dans les collections biologiques du musée de Cambridge. (Comptes-rendus Soc. entom. Belg., 1 May 1886, p. 100-101.)

Separate, 2 p., 24 × 16, t 19 × 10.5.

Abstract of H. A. Hagen's "Twelve years' experience with rubber stoppers used in the biological collection of the museum in Cambridge" (Can. entom., Jan. 1886, v. 18, p. 1-4). [Rec., 0000]. *G: D.* (4506)

**Blanford,** H: Francis. Sound-producing ants. (Nature, 10 Nov. 1881, v. 25, p. 32, 5 cm.)

Notice of rhythmical sounds produced by white ants (*termitidae*). *G: D.* (4507)

**Cameron,** M. *Lycaena icarus* hermaphrodite (?). (Entomologist, Apr. 1887, v. 20, p. 106-107.)

Note on a supposed hermaphrodite of *lycaena icarus*, followed by some remarks, by R[ichard] S[outh], on the nature of some apparent hermaphrodites in *lycaena*. *G: D.* (4508)

**Capper,** S. J. *Vanessa antiopa* with white borders. (Entomologist, May 1887, v. 20, p. 135-136.)

Quotes a letter by M. Wurzburger, of Creuznach, Prussia to show that white-bordered *vanessa antiopa* in Great Britain are hibernated specimens that have flown from the continent, and that the larva is never found in England. *G: D.* (4509)

**Carrington,** J: T. Collecting British clear-winged lepidoptera. (Entomologist, Apr. 1887, v. 20, p. 96-105.)

Notes on different species of British *sesiidae* and their life-history; preceded by a few notes on their capture and rearing and the attraction of females for males; notes on *sesia tipuliformis*, also found in N. A. *G: D.* (4510)

**Carrington,** J: T. *Pieris rapae* in Canada. (Entomologist, Mar. 1887, v. 20, p. 63.)

Note on diminution of damages due to *pieris rapae* on account of its control by parasites, and mentions sending these parasites from Europe. *G: D.* (4511)

**Casey,** T: L. Revision of the *stenini* of America north of Mexico. Insects of the family *staphylinidae*, order *coleoptera*. (Phila. 1884, pp. 206, 1 plate.)

Descriptions of 3, 1 new, species of *dianous*, 130, 112 new, species of *stenus* and 42, 36 new, species of *areus* (n. g.). Figures mouth parts and other appendages. *S: H.* (4512)

**Cockerell,** T. D. A. On melanism. (Entomologist, Mar. 1887, v. 20, p. 58-59.)

Regards humidity of atmosphere the main factor in producing melanism in animals. *G: D.* (4513)

**Copineau,** C: Remarques sur le sens du goût chez les oiseaux. (Bull. Soc. linn. du nord de la France, Feb. 1887, v. 7, p. 219-221.)

Abstract of G: F. Waters, "[Sense of taste in birds.]" (Proc. Bost. soc. nat. hist., Oct. 1883, v. 22, p. 433-434). *G: D.* (4514)

**Delaby**, E. Chasse au *rhipiphorus paradoxus* L. dans les nids de la guêpe vulgaire. —Nid de frelons détruit par un renard. (Bull. Soc. linn. du nord de la France, Jan. 1885, v. 7, p. 198-204.)

Describes a mode of killing wasps in order to take the insects in their nests; the fox attacks nests of wasps (*vespa crabro*) in order to eat the larvae in the nest; the excrement of the fox often contains elytra of coleoptera. *G: D.* (4515)

**Dingwall**, K. *Vanessa antiopa* larvae in England. (Entomologist, June 1887, v. 20, p. 156-157.)

The writer has bred *vanessa antiopa* from larvae found in England. *G: D.* (4516)

**Dobrée**, N. F. A new method of sugaring. (Entomologist, June 1887, v. 20, p. 164-165.)

Describes a method of sugaring, of which Dr. R. Benteli has given an account in *Societas entomologica* for May 1887, to be used where there are no trees; comments upon the method. *G: D.* (4517)

**Dubois**, Michel. Une chenille carnivore. (Bull. Soc. linn. du nord de la France, Nov. 1886, v. 8, p. 172-173.)

Translation, from *Humboldt*, of a note on the discovery of the aphidiphagous habits of *feniseca tarquinius* by T. Pergande, announced by C: V: Riley. *G: D.* (4518)

**Fernald**, C: H: *Vanessa antiopa*. (Entomologist, Sept. 1887, v. 20, p. 228-229.)

Discusses whitening of the yellow border of wings of *vanessa antiopa* with age. *G: D.* (4519)

**Fotheringham**, J: Sound-producing ants. (Nature, 17 Nov. 1881, v. 25, p. 55, 10 cm.)

White ants (*termitidae*) noticed to produce rhythmical sounds; form of the runs of these insects. *G: D.* (4520)

**Frey**, Heinrich. Ein hermaphrodit von *erebia euryale-adyte*. (Entom. zeitung . . . zu stettin, July-Sept. 1883, v. 44, p. 373-374.)

Mentions an incomplete hermaphrodite of *bupalus piniarius* and a more complete one of *erebia euryale-adyte;* discusses relative abundance of hermaphrodites. *G: D.* (4521)

**Frohawk**, F. W. Setting rhopalocera. (Entomologist, Jan. 1888, v. 21, p. 17.)

How to set lepidoptera to show their under sides. *G: D.* (4522)

**Gillet**, Felix. The codlin moth. (1st rept. Board state hortic. comm. Cal., 1882, p. 30-33, fig.)

Habits of codlin moth [*carpocapsa pomonella*], and means of reducing its ravages; note on usefulness of *coccinellidae* in destroying *aphididae*. *G: D.* (4523)

**Gillet**, Felix. The codlin moth. (1st rept. Board state hortic. comm. Cal., 1882, p. 24-28.)

Notes on *carpocapsa pomonella* and its habits; thinks the introduction of parasites an easy way to check its ravages. *G: D.* (4524)

**Goss**, Herbert. *Anosia plexippus*, L. (*Danais archippus*, F.) in Portugal. (Entomologist, Apr. 1887, v. 20, p. 106.)

Notes the capture of a specimen of *danais archippus* in Oporto, Portugal. *G: D.* (4525)

**Hagen**, Hermann August. Twelve years experience with rubber stoppers used in the biological collection of the museum in Cambridge. (Can. entom., Jan. 1886, v. 18, p. 1-4.)

Abstract, by A. Bergé, entitled, Résumé d'une note de M. le Dr. Hagen sur l'emploi des bouchous de caoutchouc vulcanisé dans les collections biologiques du musée de Cambridge. (Comptes-rendus Soc. entom. Belg., 1 May 1886, p. 100-101.)

Abstract, by C: Copineau, entitled, "Bouchons en caoutchouc pour les collections d'histoire naturelle." (Bull. Soc. linn. du nord d. l. France, Sept. 1886, v. 8, p. 139-140.)

Details of experience in using rubber stoppers in tubes containing alcoholic specimens of insects. *G: D.* (4526)

**Hewett**, G. M. A. Ripe plums a bait for insects. (Entomologist, Feb. 1888, v. 21, p. 65.)

Finds that many moths are attracted to ripe plums in the trees where the flies and wasps had feasted during the daytime. *G: D.* (4527)

**Hill**, T: Preserving insects. (Entomologist, Mar. 1887, v. 20, p. 66-67.)

Mode of using a solution of corrosive sublimate ($Hg\ Cl_2$) to preserve lepidoptera from the attacks of museum pests. A note by J: T. C[arrington] is added, in which naphthalin is recommended. *G: D.* (4528)

**Horn**, G: H: A monograph of the *aphodiini* inhabiting the United States. (Trans. Amer. entom. soc. 1887, v. 14, p. 1-110.)

Tabular separation, descriptions, synonomy and bibliography; 137 species are described including 14 new species of *aphodius*, 6 of *ataenius*, 1 of *pleurophorus*, 1 of *psammodius* and 3 of *aegialia*. *S: H.* (4529)

**Horn**, G: H: A study of some genera of *elateridae*. (Trans. Amer. entom. soc. 1884, v. 12, p. 33-42).

Synoptic tables and descriptions of the species of *horistonotus*, *esthesopus*, *ludius* and *eniconyx* (n. g.) are given; also descriptions and synonymical notes of some species of *aptopus*, *anchastus*, *ischiodontus* and *leptoschema* (n. g.) *S: H.* (4530)

**Horn**, G: H: A study of the species of *cryptobium* of North America. (Trans. Amer. entom. soc. 1885, v. 12, p. 85-106, pl. 1-2.)

Sexual characters, tabular separation, descriptions, synonymy and bibliography. Figures the ventral modifications in the males. *C. anceps*, *c. lecontei* (*carolinum* Lec.), *c. vagum*, *c. arizonense*, *c. vitatum*, *c. ventrale*, *c. propernum* and *c. nactum* are described as new. *S: H.* (4531)

**Horn**, G: H: *Dinapate wrightii* and its larva. (Trans. Amer. entom. soc. 1886, v. 13, p. 1-4, pl. 1.

Detailed descriptions and figures of the larva and imago of *dinapate wrightii* n. g. et n. sp. *S: H.* (4532)

**Horn**, G: H: Mr. Charles Wilt. (Trans. Amer. entom. soc. 1886, v. 13, p. 6 Proc.

Obituary notice. *S: H.* (4533)

**Horn**, G: H. Notes on the "Biologia Centrali-Americana." (Trans. Amer. entom. soc. 1886, v. 13, p. 7-11 Proc.)

Critical and synonymical notes upon the *carabidae cerambycidae* and *bruchidae* described by Bates and Sharp in Biologia Centrali-Americana. *S: H.* (4534)

**Horn**, G: H: Notes from the museum at Cambridge,. (Trans. Amer. entom. soc. 1886, v. 13, p. 11-16 Proc., fig.)

Synonymical notes upon *coleoptera* contained in the Museum comparative zoology; figures variations of elytral markings of *psoa maculata* and *ps. quadrisignata*. *S: H.* (4535)

**Horn**, G: H: Notes on the species of *anomala* inhabiting the United States. (Trans. Amer. entom. soc. 1884, v. 11, p. 157-164.)

Tabular separation, descriptions, synonymy and bibliography of 12, 1 new, species. *S: H.* (4536)

**Horn**, G: H: Revision of the species of *lachnosterna* of America north of Mexico. (Trans. Amer. entom, soc. 1887, v. 14, p. 209-296, pl. 3.

Rev. by J: B. Smith (Entom. Amer. June 1888, v. 4, p. 52-56.)

Tabular separation, descriptions, sexual characters, synonomy and bibliography of 81, 30 new species of *lachnosterna*; the plate shows structural details. *S: H.* (4537)

**Horn**, G: H: Synopsis of the United States species of *notoxus* and *mecynotarsus*. (Trans, Amer. entom. soc. 1884, v. 11, p. 165-176.)

Sexual characters, tabular separation, descriptions, synonymy and bibliography; 13, 3 new, species of *notoxus* and 3 species of *mecynotarsus* are described. *S: H.* (4538)

**Horn**, G: H: Synopsis of the *philonthi* of Boreal America. (Trans Amer. entom. soc. 1884, v. 11, p. 177-244.)

Tabular separation, descriptions, synonymy and bibliography; 85, 50 new, species of *philonthus*, 23, 14 new, species of *actobius* and 10, 2 new, species of *cafius* are described. *S: H.* (4539)

**Horn**, G: H: Synopsis of the *throscidae* of the United States. (Trans. Amer. entom. soc. 1885, v. 12, p. 198-208, fig.)

Tabular separation and description of the genera and species of *throscidae;* bibliography and synonomy; figures *pactopus hornii.* *S: H.* (4540)

**Hudson**, G: Vernon. Protective coloration. (Entomologist, Aug. 1887, v. 20, p. 193-196.)

Cites numerous instances of protective coloration among New Zealand insects. *G: D.* (4541)

**Johnson**, L. N. Butterflies in southern Connecticut. (Science, 14 Jan. 1887, v. 9, p. 36, 7 cm.)

Notes difference in abundance of species of *pyrameis* in two successive years, in Connecticut; possible proterandry in *argynnis idalia*. *G: D.* (4542)

**Kuwert**, A. *Forficula auricularia* und *scolopendra forficata*, zwei feinde der lepidopteren und der schmetterlingsammler. (Entom. zeit. . . . zu Stettin, Oct.-Dec. 1879, v. 40, p. 508-511.)

*Forficula auricularia* ate off the antennae of a large number of lepidoptera while on the spreading boards; *scolopendra forficata* bite larvae in rearing box and kill them. *G: D.* (4543)

**Landois**, Hermann. Die duftapparate bei schmetterlingen. (Jahresb. d. Westfäl. provinzial-vereins für wissensch. u. kunst für 1885, 1886, p. 34.)

Brief account of the odorific apparatus of certain lepidoptera. Tümler adds, in discussing Landois' paper, that the larvae and imagos of *pieris brassicae*, are rejected as food by hens and other birds. *G: D.* (4544)

**Lewis**, D. M. Sound-producing ants. (Nature, 19 Jan. 1882, v. 25, p. 266, 6 cm.)

Reprint. (Sci. amer., 4 March 1882, v. 46, p. 135, col. 1-2, 7 cm.)

Discusses how to find out if ants produce sounds inaudible to human ears. *G: D.* (4545)

**Matthews**, A. Synopsis of North American *trichopterygidae*. (Trans. Amer. entom. soc. 1884, v. 11, p. 113-156.)

Tabular separation of tribes and genera; descriptions of genera and species: list of species. Describes two new genera, *championella* and *pterycodes*, and three new species from the United States. *S: H.* (4546)

**Milton**, F. Preservation of neuroptera. (Entomologist, Oct. 1887, v. 20, p. 284-285.)

Mode of removing viscera and oil from neuroptera, in order that they may retain their color as specimens. *G: D.* (4547)

**Old** ants and aged spiders. (Swiss cross, Jan. 1888, v. 3, p. 21-22, 19 cm.)

An account (from H: C. McCook) of a tarantula seven or eight years old, and of a queen ant which lived to be thirteen years old. *G: D.* (4548)

**Osten Sacken**, C: Robert. Luminous insects, especially diptera. (Entom. mo. mag., July 1878, v. 15, p. 43-44.)

Brief notes on the literature of luminous diptera, homoptera, and coleopterous larvae. *G: D.* (4549)

**Plateau**, Félix Auguste Joseph. Recherches sur la perception de la lumière par les myriopodes aveugles. (Journ. de l'anat. et de la physiol., Sept.-Oct. 1886, v. 22, p. 431-457, 6 fig.)

Separate. Paris, 1886, t.-p. cover, p. 431-457, 25 × 16, t 18 × 9.7; 6 fig.

Account of the effect of light upon eyeless animals as observed by different authors, and the modes of experimentation; concludes that blind myriopods can discover as quickly as can those with eyes whether they are in the dark or in the light. *G: D.* (4550)

**Pollack**, W. Einfluss des futterkrautes auf die färbung der imago von *arctia caja.* (Jahresber. d. Westfäl. provinzial-vereins für wissensch. u. kunst für 1885, 1886, p. 26.)

Heterophagic variation in *arctia caja;* also a mode of keeping the larvae through the winter. *G: D.* (4551)

**Pollack**, W. Präparierte raupen. (Jahresber. d. Westfäl. provinzial-vereins für wissensch. u. kunst für 1885, 1886, p. 15-16.)

Mode of preserving lepidopterous larvae by pressing them between plates of glass. *G: D.* (4552)

**Popenoe**, Edwin Alonzo. The "purslane caterpillar." (Industrialist [Manhattan, Kans.], 1 Oct. 1887, v. 13, no. 7, p. 21, col. 2-4, 68 cm.)

Habits and transformations of *euscirrhopterus gloveri;* figures of egg, young and adult larva, pupa and its case, and imago. *G: D.* (4553)

**Pouchet**, Georges. Le coloris dans la substance vivante. (Revue d. deux mondes, Jan. 1872, pér. 2, v. 97, p. 74-95.)

Kinds of coloration in animals and its physical causes; mimicry, beauty and other objects of the various colors of animals; changeable colors of some animals: some of the remarks are exemplified by insect-species. *G: D.* (4554)

**Reid**, N. H. Butterfly, origin of word. (Entomologist, Mar. 1888, v. 21, p. 93.)

Asks origin of the word butterfly; answered by J: T. C[arrington]. *G: D.* (4555)

**Rendall**, Percy. A rational method of setting the under sides of rhopalocera. (Entomologist, Dec. 1887, v. 20, p. 320-322, 1 fig.)

Describes a mode of setting wings of butterflies to show the underside, as if the butterfly were settled upon a flower. *G: D.* (4556)

**Rendall**, Percy. *Vanessa antiopa* with yellow borders. (Entomologist, June 1887, v. 20, p. 156.)

States that yellow-bordered, and fresh appearing specimens of *vanessa antiopa* are found in England. *G: D.* (4557)

**Rombouts**, J. E. De la faculté qu'ont les mouches de se mouvoir sur le verre et sur les autres corps polis. (Arch. du Musée Teyler, 1883, s. 2, v. 1, p. 185-200, 4 fig.)

Abstract, by author, with same title. (La nature, 15 Dec. 1883, ann. 12, no. 550, p. 34-38, 4 fig., 178 cm.)

Engl. tr., from *La nature*, entitled, "How flies hang on." (Pop. sci. mo., May 1884, v. 25, p. 68-73, 3 fig.)

Abstract, by the author, entitled, "Über die fortbewegung der fliegen an glatten flächen" (Zool. anzeiger, 17 Nov. 1884, v. 7, p. 619-623.)

Figures magnified foot of fly and of *polydrosus sericeus;* regards adhesion to smooth surfaces as produced by capillary action of hairs of foot on drops of liquid which they pour out; estimates the force of this capillarity in relation to the weight of a fly. *G: D.* (4558)

**S[outh]**, R[ichard]. Pedigree moths. (Entomologist, Mar. 1887, v. 20, p. 60-62.)

Abstract of a paper by Francis Galton, read before Entomological society of London, Feb. 1887, in which breeding of moths from specimens selected with especial reference to certain characters with a view of obtaining certain data on heredity is discussed. *G: D.* (4559)

**Tümler**, ———. Lebensdauer der tagschmetterlinge während des sommers. (Jahresber. d. Westfäl. provinzial-vereins für wissensch. u. kunst für 1885, 1886, p. 30-31.)

The author was unable to keep *pieris brassicae* alive in a room in summer as long as eleven days. *G: D.* (4560)

**Tutt**, James W. The preservation of larvae by inflation. (Entomologist, May 1887, v. 20, p. 132-134, 1 fig.)

On inflating lepidopterous larvae. *G: D.* (4561)

**Walker**, F. A. Notes on *vanessa antiopa.* (Entomologist, July 1887, v. 20, p. 176-177.)

Notes on different occurrences of *vanessa antiopa* in England; believes it to be less abundant than it formerly was. *G: D.* (4562)

*Dr.* **Wallace** on the development theory. (Science, 17 Dec. 1886, v. 8, p. 560-563, 140 cm.)

Abstract of four lectures by A. R. Wallace on evolution, delivered in Baltimore 30 Nov., 2, 7 and 9 Dec. 1886; among the subjects dealt with were protective mimicry and other means of protection in insects. *G: D.* (4563)

## ENTOMOLOGICAL ITEMS.

Dr. A. S. Packard. The June (1888) numero of the *Popular science monthly* contains a sketch of the life and services to science of Dr. A. S. Packard. A portrait accompanies the article.

Ephemeridae.—Rev. A. E. Eaton having completed his monograph of recent May-flies (Trans. Linn. soc. Lond. s. 2, v. 3 pp. 352, 65 plates) gives in the June and July numeros of the Ent. mo. mag., a generic synopsis with annotated list of thirty-seven British species.

Entomological Club, A. A. A. S.—The next meeting of the club will be held at Cleveland, Ohio, in the High School building, on Wednesday, the 15th of August, at 9 a. m. Entomologists intending to present papers should send the titles to the same to the secretary, Prof. A. J. Cook, Agricultural College, Michigan in order that they may be announced in the programme.

LeBaron's Reports.—As state entomologist of Illinois, Dr. William LeBaron prepared the four reports for the years 1871 to 1874, the second to the fifth of the series. Prof. S. A. Forbes has copies of these which he will send to entomologists on receipt of the requisite amount of postage. The first report requires three cents postage. the second and third each two cents and the fourth six cents. Prof. Forbes' address is Champaign, Illinois.

Curculio injury to Cherries.—According to experiments carried on at the Ohio station three-fourths of the cherries liable to injury by the Plum curculio, *Conotrachelus nenuphar*, were saved by spraying the trees with London purple, used in proportion of one ounce to five gallons of water. The spraying was done soon after the blossoms fell. On check trees where the spraying was omitted the curculios did much damage. No trace of the poison was discovered on analysis of the fruit a week after spraying. Spraying with a solution of lime was also tried but was less effective, only forty per cent being saved.

Glossina morsitans.—V. Fric, natural history dealer, Wladislawgasse 21, Prague, offers among other interesting entomological material specimens of the famous Tsetze-fly, *Glossina morsitans*. This species which is allied to our common Stable-fly, *Stomoxys calcitrans*, is so injurious to horses and cattle that some portions of tropical Africa are rendered impassable. Though locally abundant the species is rare in collections. Westwood in Proc. zool. soc. London, 1858, v. 18, describes and figures three species of *Glossina* and remarks upon their supposed connection with the fourth plague of Egypt.

Bees in the Mails.—Under date of 17 July 1888 the postmaster-general announces "The Canada office having assented to the proposition of this department to admit to the mails exchanged between the United States and Canada packages of queen bees and their attendant bees when so put up as to prevent injury to those handling the mails, while at the same time allowing an easy verification of the contents, packages of bees will hereafter be entitled to transmission by mail to Canada provided they conform to the conditions prescribed for them in the domestic mails of this country, and similar packages received in the mails from Canada should be promply forwarded to their destinations and delivered to addresses."

An Army of Myriopods.—Mr. W. H. Cleaver of East Bethlehem, Pa., writes to Mr. Edwin Linton concerning an army of myriopods as follows, "they are travelling eastward in countless millions. They travel at night or in the cool of the morning and evening. They camp during the day by getting under sods, boards, stones or anything to protect them from the heat of the sun. In some places during the day they are piled up in great numbers. They do not seem to de-

stroy anything on their journey but go harmlessly along. Fowls will not eat them and birds do not appear to molest them."

Mr. Linton identifies the species, with some doubt, as the common *Polydesmus erythropygus*. *Science*, 13 July 1888, v. 12, no. 284, p. 24.

RIVERSIDE NATURAL HISTORY. — Under this title Messrs. Houghton, Mifflin and company have issued a new edition of THE STANDARD NATURAL HISTORY (S. E. Cassino & Co.). The insects occupy nearly five hundred pages of the second volume and with the exception of an appendix by Dr. Packard, and a bibliography of some of the more important publications by Mr. Woodworth, the text of the two editions is unchanged. Dr. Packard's contribution consists of a brief account of the *Thysanoptera* (*Thrips* and allies). The bibliography would have been more useful if some arrangement (either alphabetical or chronological) had been followed. Two plates, a swarm of May-flies and the Hercules beetle originally printed plain are given in color; they are taken from Brehm's *Thierleben* as are a large number of the figures. No credit is given in either of the editions for any of the illustrations; this is a mistake from every point of view. It is as important for the editors and publishers to show, as it is for the neophyte to know, that the illustrations are from eminent authorities.

ON MELANISM IN LEPIDOPTERA. — A casual observation this spring led me to form a hypothesis as to the cause and meaning of melanism in *Lepidoptera*, which appears to explain a considerable majority of the instances, and at the same time, correlates various facts in connection with it, that are otherwise of obscure import. I am not sufficiently acquainted with the literature of the subject to know whether the same hypothesis has been advanced before, but I do not happen to have met with it. Melanism appears to be a western rather than a northern form of variation, to be associated with a wet rather than with a cold climate; and it has certainly been more common of recent years, which may be attributed to the long succession (unprecedented) of wet seasons we have recently passed through. My observation was on *D[iurnea] fagella*. Twenty years ago this species afforded here an occasional dark or even black *var*. Happening to meet with one of these, I searched carefully for two seasons, but only got one black and two dark specimens. For the last year or two (result of wet seasons) they have been fairly numerous. Visiting certain oak trees with a lantern one night lately, and the same observation might, occasion favoring, no doubt have been made during the day, I found the dark *var*. quite numerous, about one to three of the ordinary form. The point I wish to call attention to is this: the afternoon had been showery, and one side of the trunk was very wet, the other dry, the wet side was of a very dark color, the dry portions pale, and, as a consequence the dark specimens of the *fagella* were very conspicuous on the dry portions, hardly visible on the wet, whilst with the ordinary form the conditions were reversed, those on the wet bark were conspicuous, those on the dry much less so. This observation appears to admit of generalising, because we know that many trunks of trees, rocks, stones, mosses, &c. are much darker in color when wet, the change often being from pale grey to black, and that most of the species that are subject to melanic variation are such as are in the habit of resting on such objects; natural selection would thus have abundant leverage to work with. I do not know whether the melanism of the Lancashire and Yorkshire districts is acknowledged to depend on the general griminess of all natural objects, trees, stones, &c., but there is no doubt that this blackness of the resting places of insects is intensified when they are wet. This hypothesis will not probably explain all cases of melanism, but it seems to be widely applicable. — T. A. CHAPMAN, in *Ent. mo. mag.* July 1888, v. 25, p. 40.

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No. 146 was issued 8 June 1888.

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 149-150.**

SEPTEMBER—OCTOBER 1888.

*CONTENTS:*



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

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(See PSYCHE for Oct.-Dec. 1884, v. 4, p. 223).

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Separates which are often thrown into the waste-basket, as useless, as too small for preservation, as duplications of parts of serials, or as valueless, are respectfully solicited. The friends of the Club are also asked to send a copy of newspapers in which they have published articles or notes on entomological subjects. If these notes are anonymous, the author's name will be acceptible information.

The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

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PSYCHE.

# HILARIMORPHA AND APIOCERA.

BY SAMUEL WENDELL WILLISTON, NEW HAVEN, CONN.

In the examination, recently, of a small collection of Diptera sent me by Mr. Charles Robertson of Carlinville, Illinois, I detected several specimens, which, upon examination, proved conclusively to belong to the genus *Hilarimorpha*, whose systematic position has been the subject of some discussion. The two other known species, both European, were first located by Schiner, the author of the genus, in close proximity to *Hilara* in the family *empidae*. Later, from a renewed study of the subject, he arrived at the conclusion that they "undoubtedly belong to the *leptidae*." Mik, more recently (Ueber die systematische Stellung des Genus Hilarimorpha Schin., Verh. Zool. Bot. Gesellsch. 1881, pp. 327-329), has presented cogent reasons why the first location by Schiner is the correct one,—arguments with which, from the study of the present closely allied species, I fully agree. Roeder has recently published some remarks upon this subject, which I regret not to find among the copies of his papers that he has kindly sent me.

Professor Mik here takes the view, I may add, that a more decisive ground for an opinion regarding the position can be expected only when the earlier stages are known, which unfortunately is not the case at present. Perhaps in such a case as the present, where there may be doubt, some important characters or mode of development in the immature stages may be sufficient to decide its position, but I am far from the belief, as I have elsewhere expressed myself, that characters drawn from the immature stages are of greater or even equal value with those shown by the adult insect. Professor Mik, with Professor Brauer, is inclined, as shown by his remarks in a recent number of the Wiener Ent. Zeit., to subordinate adult characters in classification. But, notwithstanding the deservedly high repute of both these eminent entomologists, I cannot but differ with them, in a measure at least. Resemblances, in my opinion, are everywhere of more importance than differences; I do not think it desirable to separate species or genera that show important resemblances in the adult stage, no matter how important may be the differences of larvae or pupae. The differences among the earlier forms of the *ceci-*

*domyidae*, for instance, are much more important than the differences presented by the imagines; nevertheless, one will not split the *cecidomyidae* into corresponding families for that reason. Following is the description of the new *Hilarimorpha*, whose specific name it gives me pleasure to choose in honor of Professor Mik.

*Hilarimorpha mikii*, *n. sp.*

♂ Length 4 mm. Eyes broadly contiguous. Face opaque gray, with grooves from the oral margin. Antennae brownish yellow; the first two joints short, the third oval, a little longer than broad, the anterior borders straight or gently concave to the insertion of the slender two-jointed style, which is nearly as long as the body of the joint. Thorax in ground-color black, thickly covered on the mesonotum with opaque yellowish pollen; on the pleurae with lighter, less dense pollen. Abdomen with each segment anteriorly brownish black; posteriorly broadly banded with opaque yellow, of a color somewhat lighter than that of the mesonotum. Legs yellow, the terminal joints of the tarsi infuscated. Wings blackish, a little lighter behind.

Four specimens, Carlinville, Illinois (Charles Robertson.)

The neuration is quite as figured by Mik. in the paper above quoted, for the European *H. singularis* Egg.; the wing and cells are somewhat narrower. The third antennal joint is shorter, and the style longer than in *H. tristis*. The tarsi show no trace of an empodium under a compound microscope.

For the reception of this genus a slight change will be necessary in the table of families recently published by me, as follows:

29.—Anal cell narrowly open or closed near the border; discal cell present. *Bombylidae*

Anal cell closed near the border; discal wanting. *Hilarimorpha* Schin.

Anal cell closed remote from the border. *Empidae*.

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Baron Osten Sacken published,* not long ago, an elaborate article on the systematic position of the genus *Apiocera*, in which he combated the views of Schiner as regards the location of it under the *midaidae*, and sought to show that its proper position was among the *asilinae*. Other authors have not generally been in accord with him. Wiedemann, the first who described any species pertaining to the genus, looked upon the form as that of an Asilid. Westwood, the author of the genus, hesitated between the *midaidae* and *nemistrinidae*. Macquart established a new family for the genus, locating it next the *therevidae*. Philippi described a new species as an *Asilid;* and Gerstaecker, while refusing it admission to the *midaidae*, knew not where to place it. Schiner, on the other hand, insisted upon its union with the *midaidae;* Coquillett with the *therevidae;* Brauer and Mik as forming a distinct family allied to the *therevidae*. Finally, I too would

*Berl. Ent. Zeitschr. xxvii, 287-294

give to the group a family rank, locating it between the *asilidae* and *midaidae*.

The simultaneous possession of four species, three from Australia and *A. haruspex* O. S., will, I hope, give some weight to the remarks I would here offer concerning its true systematic position. As Osten Sacken very justly remarked in a letter to me, the group is an old one geologically, and within certain limits will show wide structural variation. In one of the species, both male and female, now before me, there is no indication whatever of any anterior branch to the third longitudinal vein. The absence of this vein under some circumstances would indicate very great structural differences, but, as Cope has more than once said, generic, or even family characters in transitional forms or isolated groups may cease to have even a specific value. Here a well-marked family character among the *asilidae*, *therevidae* and the like, I am satisfied has nothing more than a specific value, if it has even that. The *apioceridae* is an old, isolated, geological form; it cannot be allied to the *therevidae* or *asilidae* without doing violence to genetic relationships. On the other hand, the *midaidae*, certainly the *nemistridae*, and perhaps also, the *acroceridae*, are all families undergoing a similar decadence; all are apparently old geologically; all show remarkable neurational variations within narrow limits, and all, except perhaps the *acroceridae*, seem to have more than an accidental coincidence in their geographical distribution. Numerous forms of *nemistrinidae* and *midaidae* occur both in Australia and South America, as I can state from the examination of specimens. I do not wish it to be inferred from the above that *apiocera* should be looked upon as only an aberrant type of *midaidae*, but rather that the *apioceridae* from their isolated position should be recognized as distinct in the same way that these other families are. In one thing I agree with Osten Sacken; the shortness of the first longitudinal vein in *therevidae* points to a more remote geological divergence. The argument of fleshy labella has little weight, for in one of the species before me the proboscis is elongate, slender, and the labella small.

My views, then, in brief are: the *apioceridae* form an isolated group approaching extinction, it is probably most nearly related geologically to the *nemistrinidae* and *midaidae*, next to the *asilidae*, and less intimately to the *therevidae*. In consideration of these views it seems to me best to recognize the group as a distinct one under the name of *apioceridae*.

One other thing that has impressed me in the examination of a considerable collection of the South American flies, and a small one from Australia, and that is the points of resemblance that exists between the dipterological faunae of the two continents. This resemblance, too, in some respects. is more than superficial. With only my small collection for comparison I have

found no less than three genera of *asilidae* identical, and unknown elsewhere.

I regret never to have seen a specimen of *Rhaphiomidas* O. S., one of those peculiar transitional forms about which opinions will differ. Baron Osten Sacken has recently rejected it from the *midaidae*, and, judging from the description of the antennae, with good reason. These organs seem to be quite like those of the Dasypogonid *Ospriocerus*. In some features the form seems intermediate between *Apiocera* and the *asilidae*, but the wing structure is so different from that of the latter family that I do not think it should be united with it. I would rather place it among the *apioceridae*. These and the many other oscilant genera in the Orthorrhaphous diptera serve only to emphasize the fact that nature abhors classification, and the only good that can come from their discussion is the elucidation of the relative values of different structural characters.

## DESCRIPTION OF ASPHONDYLIA HELIANTHI-GLOBULUS.

BY JOHN MARTEN, CHAMPAIGN, ILL.

This fly is recorded in Osten Sacken's Catalogue of N. A. Diptera, p. 5, as *A. helianthi-globulus*, Walsh (*in litt.*). Osten Sacken gives the following comparison. Trans. Am. Ent. Soc. Vol. III, p. 52.—"*A. rudbeckiæ conspicua* at first sight is not unlike *A. helianthi-globulus*, Walsh in litt., of which I owe a specimen to my lamented friend. Walsh's species, however, is easily distinguished by the paler color of its hind tibiae and tarsi. Its general color is also paler brown, with a yellowish-brown pubescence; its coxae are pale; the vein ending in the apex of the wing is less arched than in *A. rudbeckiae.*

"*A. helianthi-globulus*, Walsh, forms a rounded swelling on the stem of *Helianthus.* As it has never been described these notes may serve to identify it."

Imago, ♂ ♀, blackish brown, covered with grayish hairs (dry and alcoholic specimens become more brown); feet black with grayish hairs, femora brownish; hind tibiae, short first joint of the tarsi and the long second joint whitish tipped with black hairs. Wings clothed with dark grayish hairs, dusky; venation like that of *A. monacha*, *O. Sack.*, it consists of three veins the last of which is forked, the anterior branch being partially concealed in a fold which extends to the root of the wing; the second vein is nearly straight and ends almost in the middle of the apex. The antennae are fourteen jointed (2 + 12), filiform and pubescent; the joints of the flagellum are cylindrical, of nearly equal gradually diminishing length up to the ninth; the tenth is smaller than the ninth; the eleventh and twelfth to-

gether are about equal in length to the tenth. Halteres light brown. The ovipositor is stout, cylindrical and furnished with a long needle-like organ which protrudes beyond the tip.

Length four mm. Emerges in September and October.

The pupa has two contiguous, short, subconical projections at the top of the head; the dorsal segments of the abdomen have on the middle of each a somewhat irregular double transverse row of short spines, and behind it a single regular row of similar spines, the last segment, at the tip, has a row of such spines.

Osten Sacken compares, briefly, this pupa with *A. monacha*, Trans. Am. Ent. Soc. Vol. II, p. 301.

The galls are formed on the stem of *Helianthus grosse-serratus*, from a few inches to three feet or more above the ground; they are globular, spherical or ovate, in shape, from three-eighths of an inch to two inches in diameter.

The pupa in extricating itself from the gall may leave its case protruding from the place of exit or may drop to the ground before leaving its case.

## SOME ACCOUNT OF OUR SPECIES OF GEOTRUPES.

BY FREDERICK BLANCHARD, LOWELL, MASS.

Several familiar species of *Geotrupes* are among the first acquisitions made by the beginner of a collection of coleoptera in the Eastern United States. They are in fact so abundant and easily found that the interest in them soon ceases, and this part of one's collection makes about the poorest exhibit of the whole, from the fact that the clumsily pinned, poorly cared for specimens of our early inexperience alone appear as representatives of the species. As I have recently observed, however, in Mr. Henry Ulke's collection, a series of good examples of the different species and their varieties is an ornament instead of, as is too often the case, a disgrace to the collection. It is not always best to neglect old friends, and in our common species of *Geotrupes* the very interesting male peculiarities are quite worthy of occasional attention, as they form the basis of a natural classification.

In 1865 M. Henri Jekel published in the "Annales de la Société Entom. de France," an arrangement of the species of this genus, adopting the plan of making subgenera of the different divisions, paying especial attention to our North American species, and describing several from this country as new. A little later Dr. G. H. Horn, in 1867, in the Transactions of the Amer. Ent. Soc. vol. i, reviewed M. Jekel's paper at length as far as it related to our species, placing before American students the true relations and limits of the species at the same time very properly suppress-

ing of all M. Jekel's new species, but one, as varieties of well known species. Since Dr. Horn's paper appeared Dr. Le Conte has described *G. chalybaeus* from an imperfect specimen found in Florida, and Dr. Horn has described *occidentalis* from a single ♀ from California, giving at the same time a table for the determination of the species. In the present essay two more species are made known and as one of them is not admissible into any of the subgenera of Jekel, in order that its characters may be properly understood, it seems worth while to pass in review the different forms hitherto known in our fauna. At the same time an opportunity is afforded me by the kindness of Mr. Ulke to give some further details respecting *G. chalybaeus*. This last species by its form and structure is an obvious interruption in our series, and I have placed it at the end of the genus for the present. It seems equally out of place among any of the exotic subgenera mentioned by Jekel, and the proper course appears to be to establish a distinct genus for it.

The genus is primarily divided by Jekel into those having the second joint of the antennal club entire and into those having the second joint more or less emarginate beneath so that when the joints are closed the margin of the joint is more or less hidden. This appears to be a natural division, but in the case of *G. balyi*, the only species thus far known in our fauna belonging to the second division, there has been some confusion on the part of Jekel, and also in American collections from the fact that in many specimens the second joint of the club is only very slightly thinned at the lower margin, or even not noticeably different from the normal form. A better character for our fauna is the one pointed out by Dr. Horn, namely the greater widening of the elytral margin towards the base. In his description of *starkii*, based upon a ♀ specimen and included in the subgenus *Onychotrupes*, Jekel alludes to this broad margin in his specimen as being peculiar to *starkii* and not seen in the other species of the subgenus. Dr. Horn, however, at once recognized that *starkii* was simply a specimen of *balyi* with the antennal club normal. Another character accompanying the wider elytral margin in our fauna is seen in the sutural and second striæ of the elytra. In the first division, in all of our striate species except one, the sutural stria is interrupted by the scutellum, and does not reach the base, while the second stria is entire and reaches the base of the elytra. In the second division the sutural stria arises at the base of the elytra and follows closely the margin of the scutellum, thus interrupting the second stria which in this case fails to reach the base.

*G. balyi* was included by Jekel in his subgenus *Anoplotrupes*, the species of which do not have any special ♂ characters. While recently studying this species it was observed that in certain large quite black individuals associated with the usual dark bronzed green forms under the same name, the sexes were

very readily separated by quite unique characters in the ♂ which were entirely absent in the true *Anoplotrupes*. Following the Jekelian plan this newly recognized form should be placed as a subgenus between his *Canthotrupes* and subgenus *Geotrupes* for which the name *Melanotrupes* is suggested, and full particulars given further on.

*Geotrupes chalybaeus* is much less convex than usual, the sides of the thorax at base moderately explanate, the sides of the elytra rather strongly explanate in front, the margin being wide as in *Melanotrupes* and *Anoplotrupes*, but flatter; the epipleuræ are also horizontal instead of oblique as usual; there is within the margin a marked constriction of the sides of the elytra behind the humeri. The most remarkable peculiarity of the species is in the form of the middle and hind tibiae. Instead of having the apex on the outer side indicated by a well-defined ridge as usual, the ridge is completely absent, and only its position is indicated by two or three bristles, so that the apex as seen from above or below is broadly rounded or very obliquely truncate. This character appears to be quite anomalous in *Geotrupes*, as, if it had existed in any of the species known to Jekel it would have been noticed, as he is very particular in giving the form of the tibiae and the number of transverse ridges on the outer face counting the apical as first. Some further particulars will be given under this species below. The name *Peltotrupes* might be used for this subgenus.

The following arrangement of the subgenera is based upon Dr. Horn's, given in the "Transactions," vol. i.

*a.* Middle and hind tibiae with apical ridge on the outer side.

- *b.* Apterous, elytra connate, metasternum short, thorax dissimilar anteriorly in the two sexes, elytra not striate. *Mycotrupes.*
- *bb.* Alate, elytra free. thorax similar ♂ and ♀.
  - *c.* Elytral margin moderate, antennae with the second joint of the club normal, entire, apex of anterior tibiae produced inwardly in the ♂, simply toothed in the ♀.
    - *d.* Middle tarsi of the ♂ very short and thick, claws of the same chelate. *Onychotrupes.*
    - *dd.* Middle tarsi and claws of the ♂ normal. *Cnemotrupes.*
  - *cc.* Elytral margin broad towards the base, second joint of antennal club more or less emarginate or truncate beneath, but sometimes not distinctly so, sutural stria reaching the base, second interrupted, apex of anterior tibiae alike in both sexes.
    - *e.* ♂ with anterior thighs toothed at base, anterior tibiae with the third tooth from the apex deflexed, partly inferior. *Melanotrupes.*
    - *ee.* The sexes alike. *Anoplotrupes.*

*aa.* Middle and hind tibiae without external apical ridge. *Peltotrupes.*

The only species of *Mycotrupes* is *retusus* Lec. "found in the southern states feeding on fungi or under dried animal matter."

Of *Onychotrupes* there are two species in our fauna, *splendidus*, variable in brilliancy of color from "brilliant metallic green to a dark bronze," the elytral striae are punctured, the basal margin of the thorax is entire. Second, *semiopacus*, having the head not tuberculate, the thorax usually with the basal marginal line absent in a greater or less degree and with the striae of the elytra impressed but not punctate, interstices flat, smooth. The ♂'s in this subgenus have the hind thighs with a small tooth, more or less marked, at the base beneath. The inferior longitudinal carina of the anterior tibiae is distinctly serrate in both sexes of *splendidus*, but only feebly crenate in *semiopacus*. The middle and posterior tibiae have usually four distinct transverse ridges on the outer face in both.

As only the ♀ of *G. occidentalis* is known it is not certain that it is a *Cnemotrupes*. I have however included it in the following table:

Thorax with basal margin entire.
- Anterior tibiae of ♂ with a long spur, scutellum transverse.
  - Shining dark bronzed green, elytral striae coarsely crenately punctured, club yellow. *egeriei*.
  - Opaque, striae punctured, scarcely impressed, club sooty. *opacus*.
- Anterior tibiae with a short spur in the ♂, scutellum equilateral, striae rather finely punctured. *blackburnii*.

Thorax with basal margin obsolete at the sides.
- Elytral striae very feebly impressed, punctured, head not tuberculate, apical spur of ♂ short, scutellum very small. *ulkei*.
- Elytral striae impressed and punctured, head tuberculate. *occidentalis*.

In the first three species the hind thighs are toothed in the ♂ and the inferior carina of the front tibiae is serrate in both sexes, more strongly in the ♂, and in *blackburnii* the alternate teeth are sometimes very prominent. The middle and hind tibiae in the same species have about four transverse ridges, the upper one sometimes imperfect.

*Geotrupes ulkei* n. sp.—Size small, convex, shining brown bronze, lateral margins of the thorax and elytra blue. Head shining, rough in front and at the sides, rather sparsely punctate behind, clypeus broadly rounded in front, feebly convex without any evident tubercle, sides of the head rounded as usual forming at its junction with the clypeus an obtuse reentrant angle, clypeal sutures impressed, the usual ante-ocular ridges present. Antennae with the fourth joint shorter than the third or fifth, club sooty. Thorax nearly twice as wide as long, the apex more than half as wide as the base, sides strongly rounded and margined, angles all rounded, base lobed at middle, marginal line distinct at middle, quite absent each side, surface faintly punctulate, very sparsely punctured on the disc except on the median line which is slightly impressed

and more closely punctured, punctures more numerous at the sides where the usual fovea is evident. Elytra about twice as long as the thorax and scarcely wider, slightly narrowed at base thence with the sides broadly rounded to the apices which are prominent and not at all inflexed. Stiiae fine and but feebly impressed, with rows of small punctures, intervals flat with a sparse and rather indistinct punctulation, scutellum equilateral, smaller than usual so that the sutural striae reach the base, but they are not so near the scutellum as in *G. balyi* etc., nor do they interrupt the second striae which reach the base as usual in the subgenus. Body beneath black or slightly bronzed, rather sparsely clothed with brown pubescence and bristles; mesosternum with a prominent somewhat semicircular crest between the coxae; middle tibiae shorter than the posterior ones, gradually wider like them, but thicker when viewed laterally, both pairs have three distinct transverse ridges counting the apical one; the anterior tarsi are more slender than the others, the first joint short, the second equal in length to the third and fourth united, but more slender; in the middle and hind tarsi the first joint is elongate nearly equal to the next three which are but little longer than wide and gradually decrease in length and thickness, last joint longest in the middle tarsi, about equal to the first joint in the hind pair, longest spur of middle and hind tibiae equal to the first three joints in the ♂, scarcely longer than the first two joints in the ♀. Anterior tibiae with five or six lateral teeth, the inferior ridge finely, sparsely, crenulate or denticulate in both sexes. In the ♂. the apex of the front tibiae is strongly, acutely produced obliquely inward and forward, the terminal spur is short not very stout about equal in length to the second joint of the tarsi. Hind thighs unarmed.

Length, ♂ 11 mm., .44 in.; ♀ 12 mm., .48 in.

One pair Va. found by Mr. Ulke in fungi.

On comparison with diminutive specimens of *blackburnii* and *balyi* of the same size, the scutellum is seen to be distinctly smaller in the present species.

It affords me great pleasure to give Mr. Ulke's name to this interesting little species in recognition of many favors.

In the subgenus *Melanotrupes* the following described species only is known to me:

G. hornii, n. sp.—Black, shining, without any metallic reflections clothed beneath with dark brown hair, form robust. Clypeus oval, a little more prominent in the ♀, its entire surface rugose punctate, a distinct tubercle behind more or less acute, the sutural impression deep, the anteocular ridges of the head are well marked, the sides rounded as usual; antennae with the fourth joint shorter than the third or fifth, club yellow with the second joint more or less emarginate or truncate and thinner below; thorax of the usual form, broadly emarginate in front, the

angles distinct scarcely rounded, somewhat obliquely wider to the middle, thence rounded and inflexed at the posterior angles which are rounded, usually a little wider behind the middle, a median impressed line more or less punctate, disc sparsely and irregularly punctate, sides more closely, the usual lateral fovea distinct, basal margin distinct; scutellum triangular as usual, smooth or with a few punctures, sometimes impressed; elytra about as wide as the thorax, a little narrower at the base, broadly rounded to the apex which is obtuse, the margins slightly inflexed at the suture, striae strongly impressed and crenately punctured, rather more coarsely than in *balyi*, intervals convex, smooth, sutural striae embracing the scutellum and reaching the base, second stria more or less interrupted by the sutural and not reaching the base, margin of elytra much wider anteriorly; anterior tarsi with joints one to four subequal, last joint nearly equal to the three preceding; spurs of anterior tibiae long in both sexes, reaching the apex of the third joint of the tarsi or beyond; mesosternum carinate between the coxae, produced forward in a rounded crest; middle and hind tibiae with three transverse ridges on the outer face, the upper one incomplete, middle tibiae shorter than the last, the tarsi also a little shorter with the first joint about equal to the next three together, while in the last, the second, third and fourth joints are a little more elongate and together obviously exceed the first in length; spurs of middle and hind tibiae long and slender, the longer one of the middle tibiae reaching the apex of the third joint, that of the hind tibiae reaching the apex of the second joint; inner apical process of the hind tibiae subparallel, rounded at tip and one-half as long as the first joint of the tarsi. The ♂ has the base of the anterior thighs below with a conspicuous oblique ridge or broad tooth, the anterior tibiae with the third tooth from the apex deflexed and produced beneath, sometimes meeting a slight angulation of the inferior carina, this carina at about one-third from the base has a prominent tooth. The ♀ has the anterior thighs and tibiae simple.

Length 13.-18. mm; .52-.72 in.

Specimens are before me from Mass., D. C. and N. C. and I infer that the species has a similar distribution with our common species. It appears to have been sufficiently rare to have escaped the earlier authors and later has probably been confounded with *balyi* from which it differs apart from the sexual characters by the always distinctly black color without any metallic reflections, the more advanced clypeus, the less sparsely and rather more strongly punctured thorax, the mososternal crest rounded instead of acute, the hind tibiae with the upper or third ridge more developed and the apical process longer and narrower at base. So far as observed the emargination of the second joint of the antennal club is well marked.

In dedicating this very distinct

species I would express my hearty admiration of the great zeal and success in studying our Coleoptera, of Dr. Geo. H. Horn.

Of the habits of *G. hornii* I cannot now say much. Mr. Ulke writes me that he finds it under electric lights in Washington, but that he does not thus find *balyi*, which is common, he says, in the mountains of Virginia. The latter species is also common about fungi in Massachussets.

*Anoplotrupes* has but one species in our fauna, *balyi*, sufficiently defined by the table of subgenera and the comparative notes above. It is usually smaller than *G. hornii*, the color is usually a deep black green and always more or less metallic. Specimens have been seen with the bottom of the striae distincly purple, others have the whole surface of the elytra and even the thorax purple.

*Peltotrupes chalybaeus* is polished black blue with the lateral margins of a brighter blue, three or four striae next the suture on each side are impressed, the others hardly impressed, all have rows of fine punctures. The anterior tibiae have on the upper surface the usual inner impressed line bearing a row of setae but the adjacent outer carina is quite absent. The middle and hind tibiae are rather densey fringed with spines on each outer margin and on the cross ridges and the spaces between are punctate and bear short bristles; in our other *Geotrupes* the middle and hind thighs are flattened posteriorly to receive the tibiae, and have the margins finely elevated each side, while in *chalybaeus* they are convex behind with a single strong margin which is next to the upper side.

The middle and hind tarsi are rather thickly beset with long bristles; the claws are long and slender.

In the ♂ the apex of the anterior tibia is abruptly and strongly produced inwardly and the spur is rather short; there is a small tooth directed inwardly behind the insertion of the tarsi; the inferior carination of the tibiae is armed with three or four prominent teeth alternating with finer ones, the hind thighs are toothed at base. The ♀ has not been seen by me.

The third and fourth joints of the antennae are equal, fifth to eighth gradually shorter aud thicker.

In the preceding pages I have had all of the species mentioned before me with the exceptions of *retusus* and *occidentalis* and I have freely availed myself of the information given by Dr. Horn in his paper.

## GEOTRUPES Latr.

### Mycotrupes Lec.

*G. retusus* Lec. Proc. Acad. 1866, p. 381.

### Onychotrupes Jekel.

*G. splendidus* Fabr. Syst. Ent. p. 18, no. 63.
*miarophagus* Jekel, Monog. loc. cit. p. 611.
*var. mixtus* Horn. Trans. v. 1. p. 316.

*G. semiopacus* Jek. l. c. p. 612.
*melsheimeri* Jek. l. c., p. 613.

CNEMOTRUPES Jekel.

*G. egeriei* Germ. Ins. Spec. i, p. 144.
*lecontei* ♀ Jek. l. c., p. 592.
*G. opacus* Hald. Proc. Acad. 1853, p. 362.
*haldemani* Jek. l. c., p. 593.
*chevrolati* Jek. l. c., p. 595.
*G. blackburnii* Fabr. Spec. Insect. i, p. 20, no. 85.
*excrementi* Say, Jour. Acad. iii, p. 210.
*var. jekellii* Horn l. c., p. 317.
*conicollis* Jek. l. c., p. 591.
*G. ulkei* n. sp.
*G. occidentalis.* Horn Trans. v. viii, p. 144.

MELANOTRUPES.

*G. hornii* n. sp.

PELTOTRUPES.

*G. chalybaeus* Lec. Proc. Am. Phil. Soc. v. xvii, p. 402.

## NOTE ON CHINCH BUG DISEASES.

BY STEPHEN ALFRED FORBES, CHAMPAIGN, ILL.

Two diseases of *Blissus leucopterus*, apparently efficient in suppressing an outbreak of this species in 1882, were described by me in my Report for that year as State Entomologist of Illinois (pp. 47–54); but neither of these has been distinctly recognized since, until the present season. Now, however, the chinch bugs of the southern part of Illinois are being very rapidly destroyed by both these diseases, and a third not hitherto recognized,—the last (seen by me first in July, 1887) due to a *Botrytis* distinct from the species (*B. bassiana*) well known as the characteristic fungus of muscardine in the silkworm.

One of the two first mentioned is caused by an *Entomophthora* whose specific affinities I have not been able to learn.

The other is due to a microbe (the *Micrococcus insectorum* of Burrill*) principally developed in the alimentary canal, and especially in its cœcal appendages, which are often literally crammed with it from end to end. This disease somewhat resembles that known as *schlaffsucht* or *flacherie* in the literature of the silkworm. Its germ is freely cultivable both in beef broth and in solid gelatine media, by the processes usual in bacterial investigation.

Both the *Entomophthora* and the *Botrytis* finally imbed the insect in a white fungus,—the efflorescence of a spore-bearing mycelium. The *Botrytis* has been much more abundant

*American Naturalist XVII, p. 319. This microbe, studied anew by Prof. Burrill from my recent cultures, solid and fluid, and from the affected chinch bugs themselves, proves to be a *Bacillus* of peculiar character, and not a *Micrococcus*.

and destructive in Illinois than the Entomophthora, although seemingly less so at present than the bacterial form.

It now seems likely that these diseases, occurring as they do spontaneously over a large area, will soon suppress what has probably been the longest-continued destructive outbreak of the chinch bug known in the history of that insect. Their present activity is illustrated by the fact that in a single field in Southern Illinois dead chinch bugs imbedded in this mold were found by an assistant, Mr. John Marten, so numerous as to suggest a recent flurry of snow.

## NOTES ON THE WHITE ANT, FOUND ON THE BAHAMAS.

BY CHARLES J. MAYNARD, NEWTONVILLE, MASS.

Among the many objects of interest that engage the attention of the Naturalist on the Bahamas perhaps the most striking are the nests of the White Ants. The first that I saw was in the vicinity of Nassau in a cultivated field. It is the custom among the natives upon clearing away any portion of the low growth of trees, that occupy the land before it is tilled, to leave certain ones which serve for bean polls, or as a support for the stem of the yam which climbs to a considerable hight. The tree usually selected is the gumbo limbo, that has long naked branches, the twigs of which are only scantily supplied with leaves. These trees are so very often chosen by the ants as a support that it is not infrequent to see two or three nests in one field placed on them. The color of these domiciles is nearly black and as they are often of a large size they form conspicuous objects, even when seen from a distance.

The nest, of which I have spoken, was placed upon a limb some three feet from the ground, was about four feet high by some two feet in diameter and was very nearly of the form of an old fashioned bee hive. This object in the midst of the field presented such a singular appearance that it was only upon close observation that I convinced myself that it was not something made by the owner of the field, and placed there by him for some purpose.

Subsequent observation showed that the ants prefer to build in openings, and that the gumbo limbo is a favorite tree on which to place their nests; this may be explained by the fact that the trunks of these trees are covered with a smooth bark thus rendering the covered passages that the insects build between the ground and nests more easy of construction than on rougher material. There are two reasons, that appear plausible, why the ants prefer open fields to less exposed and more shady locations; the first of which is that they like the hot sunshine and free circulation to dry the moist material which is used in the

construction of the nests, second the materials from which they gather their building supplies, and which consists of dead wood, palm leaves, boards, shingles, etc., etc., are much more abundant in the fields than elsewhere. In fact so universally are these situations chosen that I do not now remember ever having seen a nest in any other place.

The nests, as related, are most often placed in trees, generally low and near the trunk, but I have occasionally seen them among the branches. I have also seen them on stumps and even on rocks, although this suppoıt is rarely used.

In form, the nests are, as remarked, hive-shaped whenever the basal support is large, but if it be small the ants will then build around it, producing another hive-shaped structure with its base upward which, resting against the base above, results in an oval-shaped nest. Sometimes, owing to the situation, irregularly formed nests are seen, but there is always a tendency to assume the hive shape. The nests are composed of various galleries about .20 of a inch high and about the same width, of varying length, opening into others in many directions, thus the whole system forms an exceedingly complicated labyrinth, the clew of which is difficult to find, but which appears to be perfectly understood by the insects. From the nests to the ground and whenever the passages cross rocks, the surfaces of which are exposed, and this frequently occurs even at [illegible] considerable distance from the [illegible] the road ways by [illegible] .avel are always covered. These thoroughfares are of sufficient width to allow the insects to pass freely at all points, and upon breaking down any portion of a gallery they may be seen hurrying in both directions.

Whenever their passage ways are broken open some of the ants at once begin to repair it, and this brings me to the material used in building, and the method of depositing it. Fibers, gathered from dead wood, leaves, etc., and mixed with enough earth to give it a dark color form the principal portion of their building material. How this is applied, was for a long time, a mystery to me, for although I had seen many hundred nests it was not until Dec. 19th of last year that I chanced upon one of them upon which visable labor was being performed. I was passing a nest that stood on the margin of a field on Andros, when, attracted by its size, it being the largest that I had ever seen, measuring six feet in height by four and a half in diameter, I turned aside to examine it, and perceived that a circular piece some six inches in diameter was being built on one side. Something over two inches of the outer margin of this portion had been completed, leaving a circular hole in the centre. On this portion the ants were at work, standing around the unfinished margin as close together as possible without interfering with one another's movements. The workers are constantly changing, as one disappeared another took its place. Upon appearing each ant had its jaws filled with

building material and as it reached the wall it turned and exuded a drop of mucilaginous fluid from the abdomen then whirled instantly about and deposited its fibers upon it as it lay on the wall, mixing and moulding the mass with its jaws. This pulp had about the consistency of papier mache and was readily manipulated forming a wall of about the thickness of heavy writing paper. This hardens rapidly, but remains pliable for some time, thus the walls on the extreme outer edge of the newly erected portion could be bent without breaking, whereas the older portions are quite brittle.

As the orifice on which the ants were employed grew smaller, fewer and fewer could find room, yet there was no crowding, each keeping his accustomed distance from his fellows, so one after another they disappeared, as I watched, until but one was left to complete the minute hole remaining.

These ants are very destructive to buildings, especially to the small houses of the negros, and when they have once obtained a foothold the house is doomed. I knew of a small house in the neighborhood of Nassau that had not been occupied for a year or two that was two-thirds devoured by them. There was a nest on the roof, supported by the rafters, around which all the shingles had disappeared, while others were much eaten and all the posts were thickly perforated with their galleries. Such was the speed with which the ants worked, through industry and numbers, that the eroded surfaces appeared quite fresh, being of nearly the color of newly cut wood. The owner of this house informed me that he had destroyed every trace of the nest many times only to see it rebuilt, as fast as the ants could construct it.

[NOTE. Unfortunately Mr. Maynard did not preserve specimens of this termite for indentification and Dr. Hagen in his Monographie der Termiten does not mention any species from the Bahamas. In 1883 Mr. B. H. Van Vleck collected large numbers of *Eutermes ripperti* at Nassau, and Mr. Maynard's observations undoubtedly refer to this species, which is common upon many of the West Indian islands and in South America. See, Proc. Bost. Soc. Nat. Hist., December 1877 v. 19, p. 267–274 for Notes on the tree nests of Termites in Jamaica by H. G. Hubbard.—S: H.]

## WALCKENAER'S NAMES OF AMERICAN SPIDERS.

BY JAMES HENRY EMERTON, BOSTON, MASS.

Mr. Henry C. McCook has called attention in the Proceedings of the Philadelphia Acad. of Nat. Sciences to the names of American spiders published by Walckenaer, and the necessity of using them in place of latter names given by Hentz and others.

There is no doubt that as far as these names can be identified with certainty and shown to be the oldest, they ought

to be used for the species to which they belong but the difficulty is, as Mr. McCook shows in this article, in their identification.

Walckenaer, as is well known, never saw the American spiders that he named. He bought a large number of drawings of spiders made in Georgia by John Abbot and published descriptions of the drawings, so that the first step in identifying Walckenaer names is to identify the drawings by Abbot.

The only known drawings of spiders by Abbot are in the library of the British Museum where they have been for a long time and have been shown to any person interested in them. These are probably the same drawings used by Walckenaer as Mr. McCook has compared the numbers and notes upon them with those referred to in Walckenaer's descriptions of similar spiders and found them to be the same.

Mr. McCook is inclined, however, to set too high a value on these drawings, for although his engagements prevented "him giving more than an hour or two to the study of the figures," and as far as mentioned, no American spiders were compared directly with them, he undertook to identify, off hand, a considerable number of them, a partial list of which he gives in this article with the revised names by which, as he says, "they must hereafter be known if Walckenaer's names are to be accepted."

In 1875 I looked over these same drawings at the British Museum and like Mr. McCook made hasty identifications of such few of them as I could. In my notes made at the time I find the following list.

4. Epeira placida Hentz.
54. Linyphia communis Hentz.
55. Young Linyphia marmorata Hentz.
65. Mubiona gracilis Hentz.
77,78. Uloborus.
79,80. Epeira caudata Hentz.
117. Epeira thaddeus Hentz.
116. Epeira insularis Hentz.
121. Epeira insularis.
122. Theridion sphaerula Hentz.
556. Epeira insularis.

A comparison of the numbers shows that only five of these identifications agree with those of McCook showing the uncertainty of off hand identifications of these drawings by two persons both familiar with the common spiders of the northern states.

The greater number of Abbot's drawings represent the spiders only in the most general and indefinite way and it seems to me improbable that any large number of them can ever be identified. At any rate this cannot be done until the spiders of the southern states have become better known. An attempt now to apply as many as possible of Walckenaer's names to any spiders that his descriptions or Abbot's drawings may possibly belong to, will only increase the number of uncertain names in use and so add to the labor of every future student of the subject. After the common spiders all over the United States have been described and are known to several students it will be possible to compare them with the descriptions of Walckenaer, Koch and Hentz with some prospect of finding out what these old descriptions are really worth and how many of them can be referred with certainty to particular species of spiders. With the present small number of students of American spiders it seems to me safer for each to use such names as appear to him the most certain even if not the oldest and leave the law of propriety and the "credit of entitulation" to take care of themselves.

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*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name, as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic; G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

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Fr. tr., by M. Dubois, entitled "Caractères et particularités du monde des insectes." (Bull. Soc. linn. du nord d. l. France, 1885, v. 7; Mar., p. 231-235; Apr., p. 251-253; May, p. 264-267; June, p. 281-284; July, p. 293-297; Aug., p. 310-314; Sept., p. 325-329.)

A popular lecture on insects, and on their habits. *G: D.* (4611)

**Scudder,** S: Hubbard. *Dictyoneura* and and the allied insects of the carboniferous epoch. (Proc. Amer. acad. arts and sci., Dec. 1884 [Jan. 1885], v. 20, p. 167-173.)

Species of *dictyoneura* and allied genera, which were for a time regarded to be neuropterous, and some species previously referred to the *termitina*, are here referred to the orthoptera, and a synopsis of the genera with brief notice of each species is given; the genera are *titanophasma, litoneura* n. g., *dictyoneura, polioptenus* n. g., *breyeria, goldenbergia* n. g., *haplophlebium* and *paolia*. *G: D.* (4612)

**Smith,** J: B. The Colorado beetle. (Entomologist, Apr., 1888, v. 21, p. 117.)

Notes on the distribution of *chrysomela decemlineata* and *aramigus fulleri*. *G: D.* (4613)

**Trelease,** W: Preliminary list of Wisconsin parasitic fungi. (Trans. Wisc. acad. sciences, arts, and letters, 1881-1883, v. 6. p. 106-144.)

List of Wisconsin fungi that are parasitic on plants and animals, including insects. *G: D.* (4614)

**Tutt,** James W. The educational value of entomological collections. (Entomologist, Sept. 1887, v. 20, p. 245-251.

General discussion of the educational value of collecting insects, and of the value of insect-collecting as a recreation, *G: D.* (4615)

**Underwood,** Lucien Marcus. The progress of arachnology in America. (Amer. nat., Nov. 1877, v. 21, p. 963-975.)

Review of papers that have been published on the *arachnida* of North America; synopsis of the families of *araneae*; list of the principal works on the American *araneae*. *G: D.* (4616)

**Wailly,** Alfred. Note sur les bombyciens séricigènes de l'Inde. (Bull. Soc. d'acclim. Paris, Nov. 1881, s. 3, v. 8, p. 695-708.)

Separate, Paris, 1882. t.-p. cover, 14 p., 23 X 15, t 17 X 9.4.

Besides notes on other *bombycidae* the author gives notes on the life-history of *samia gloveri, telea polyphemus* and *ceratocampa imperialis*, from the United States. *G: D.* (4617)

**Wailly,** Alfred. Notes on silk-producing bombyces — 1885. (Entomologist, 1887, v. 20: May, p. 127-131; June, p. 152-156.)

Notes on different species of *attacus* reared in captivity; among other species, *a. cynthia, a. luna, platysamia cecropia* and *telea polyphemus*. *G: D.* (4618)

**West,** W. B. The red spider. (1st rept. Board state hortic. comm. Cal., 1882, p. 20-21.)

Habits of the red mite [*tetranychus telarius*], and account of experiments upon it with various insecticides. *G: D.* (4619)

**Which** was caught? (Swiss cross, Jan. 1887, v. 1, p. 32, col. 1, 7 cm.)

Two accounts of spiders attacking bees that had been entangled in their webs, the bees escaping and carrying away the spiders in their flight. *G: D.* (4620)

**Wickson,** E. J. The "smut" fungus, *fumago salicina*. (1st rept. Board state hortic. comm. Cal., 1882, p. 91-94, fig.)

Figures *fumago salicina* and describes how it is an indication of the presence of scale insects [*coccidae*] because it grows upon their sugary secretions scattered on plants *G: D.* (4621)

[**Wilder,** Burt Green.] List of scieniific publications. 4 p., 24 X 16, t 17 X 9.4.

List of 88 papers on scientific subjects, including a number on *araneae*, by B. G. Wilder, professor in Cornell university; reprinted from *The Cornell review* for April 1885. *G: D.* (4622)

**Wilder,** Burt Green. A spider's engineering. (Pop. sci. mo., May 1873, v. 3, p. 112-113, 39 cm.)

Account of how spiders bridge chasms and streams by sending out a line of silk in the wind. *G: D.* (4623)

**Willard,** S: Wells. Migration and distribution of North Ameaican birds in Brown and Outagamie counties. (Trans. Wisc. acad. sciences, arts, and letters, 1881-1883, v. 6, p. 177-196.)

On page 193 the author gives a list of 23 insectivorous birds, with notes on their times of arrival, and considers how food-supply influences the date of migration of birds. *G: D.* (4624)

## ENTOMOLOGICAL ITEMS.

A NEW BEE-ENEMY.—According to a correspondent of the *Magdeburger zeitung*, quoted by Dr. Ferdinand Rudow in *Societas entomologica*, *Tabanus bovinus* attacks and kills the honey.bee (*Apis mellifica*) much in the same manner as *Asilus* does.

MR. Albert Koebele, for some time stationed at Alameda, Cal., as an agent of the Division of entomology, U. S. Department of agriculture, has sailed for Australia. His object is to study the parasites of the Cottony-cushion scale, *Icerya purchasi*.

TYLER TOWNSEND. Our correspondent, now assistant in the Division of entomology, U. S. Department of agriculture, who has written formerly over the signature "C: H: Tyler Townsend," informs us that he has decided to drop the given names "C: H:", and to be known hereafter as "Tyler Townsend."

METAL-CUTTING BEETLE.—Mr. F. W. Devoe, in a paper in the July numero of the Journal of the New York microscopical society. describes how *zopherus mexicanus*, a beetle commonly known in Central America under the name "makeche," eats through pewter. Figures of the mouth-parts of the beetle are given.

CHANGE OF TITLE.—The Correspondenzblatt des Entomologishen vereins "Iris" zu Dresden will hereafter appear under the title "Deutsche entomologische zeitschrift, herausgegeben von der Deutschen entomologischen gesellschaft. Lepidopterologische hefte, herausgegeben von dem Entomologischen vereine "Iris" zu Dresden."

VITALITY OF THE LARVA OF DERMESTES.—At the meeting of the New York microscopical society, 4 May 1888, "Mr. F. W. Leggett announced the death of his larva of *Dermestes*, which had withstood, for five months and twenty days, solitary confinement in a closed cell, and had subsisted during that period upon its own cast skins, having moulted five times."

EFFECT OF POISONS ON GYRINUS.—M. V. Brandicott (Bull. mens. Soc. linn. du noid d. l. France, July 1887, v.8, p. 296), in a review of a paper by M. Charles Richet (Revue scientifique, 1886, v. 37, p. 10–17, 44–49) says:

*Gyrinus natator*, hatched in a solution of 0.25 per cent of atropin, were better developed and lived longer than others hatched in distilled water.

Adult *Gyrinus* put in poisoned solutions died at the end of 24 hours in veratrin, strychnin, and cinchonin; after 5 days in atropin, and after 12 days in morphin.

POISON-APPARATUS OF THE MOSQUITO. My former notes on this subject (*Science*, 26 August, 1887; *Proceedings of the American Association* 1887) require amendment in the following respects: (1) the poison-fang is simple, being in fact the hypopharynx, as was suspected by Dimmock; (2) the paired branches of the poison-duct run backwards into the prothorax; (3) the secreting glands are in two paired systems, one system in each side of the prothorax. Each system consists of three trifoliate glands, the mid-gland being poisonous, the lateral ones salivary; the three ductules uniting into the branch of the poison-duct of its own side. The other details are as before described. G. MACLOSKIE (*Science* 21 September, 1888, v. 7, p. 144).

RHYNCHOPHORA. Lieut. Thomas L. Casey continues his descriptions of new North American coleoptera in the Annals New York academy of sciences, 1888 v. 4, p. 229–296. In the introductory pages, referring to his collection of Pacific coast beetles, the author says, "it has been my special aim to obtain as large a series as possible of every species, for the purpose of studying variation, and these series have already proved one of the greatest aids in estimating the validity of closely allied forms." It is to be regretted that this quotation cannot apply to the *rhyncophora*, a group where large series are particularly important. Fifty-five new species are described. twenty-five are uniques and of forty-four less than four specimens were at hand when the descriptions were drawn up. Though stated, p. 229, as "issued August

1888" the paper was not received until October.

NON-DEVELOPMENT OF A WING IN MELITAEA.—A few days ago I captured, in this locality, a specimen of *Melitaea minuta*, Edw. which had the normal appearance except in one respect—that the right lower-wing had failed to expand more than to a very sligh degree, and presented just such an appearance as the wing of a ♀ *Orgyia antiqua*. There can be no doubt that this malformation was due to an abnormal coalescence of the walls of the veins of the wings, and their occlusion in consequence—adding another case to the many already known in which what is quite abnormal and pathological in one species is normal in another; for the so-called apterous females of certain moths may well be supposed to have descended from winged forms, and to be, in fact, perpetuations of a condition which was once as truly pathological in them as it is now in *Melitaea*. The extraordinary variety of *Ocneria dispar*, which has the lower-wings notched, and breeds true in captivity (Entomologist, 1878, p. 170, fig.) is probably of like nature, and further illustrates this phenomenon.—T. D. A. COCKERELL, in *Ent. mo. mag.*, Sept., 1888, v. 25, p. 93.

BUTTERFLIES OF NEW ENGLAND. From a prospectus dated Cambridge 1 October 1888, we note the speedy publication of Mr. Samuel H. Scudder's Butterflies of New England. The sample sheets accompanying the prospectus show a handsome page of imperial octavo size printed in clear type with liberal margins. The work will be fully illustrated with 96 plates of which 40 or more will be colored; 17 will be devoted to butterflies, 22 to the early stages, 33 to structural details in all stages of life, 2 to parasites, 19 maps and groups of maps and 3 portraits. A novel and interesting feature is the illustration of the North American distribution of the species upon a separate colored map. The plan of the work includes an introduction treating of the general structure of butterflies in their different stages and he naturet of their metamorphoses, a chapter on their classification, an account of the embryology of one of the common species and the internal anatomy of another. The descriptions will include not merely the perfect form, but when possible the egg, caterpillar in all stages and the chrysalis. Under each species will be given, so far as possible, accounts of the secondary sexual peculiarities, particularly of the scales; the general distribution of the insect, and its special distribution in New England; its haunts and comparative abundance; its selection of places in which to deposit eggs, and the manner of oviposition; the food-plants habits, and nests of the caterpillar; the number of broods and seasons of the insects; its winter life; the habits and characteristics of the flight of the butterfly, with its attitudes when alight; its dimorphism, and other variations; its enemies and its protection from them; and under each species, a list of the points on which additional light is needed as hints for the future observer. The hymenopterous and dipterous parasites attacking the eggs and caterpillars of our butterflies are described by Mr. L. O. Howard and Dr. S. W. Williston.

At first intended to embrace only the butterflies known to occur in New England or its immediate confines, it has been extended so as to include in the descriptions and histories some account of all the butterflies of North America east of the Mississippi, excepting such as are found only in the unsettled parts of Canada or south of Kentucky and Virginia.

The work will be issued in twelve monthly parts beginning with November 1888, each part will contain 8 plates and about 144 pages of text. It will be sold only by subscription for the complete work—$5.00 per part payable on issue, or $50.00 for the whole work if paid before 1 January 1889.

Payments may be made by Draft on New York or Boston, or by Domestic or International Postal Money Order to Samuel H. Scndder, Cambridge, Mass., U. S. A.

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Nos. 147–148 were issued 18 August 1888.

PSYCHE

A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

Vol. 5. No. 151-152

NOVEMBER—DECEMBER 1888.

CONTENTS:



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

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(See PSYCHE for Oct.-Dec. 1884, v. 4, p. 223).

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The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

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# CONTRIBUTION TO A KNOWLEDGE OF THE AUTUMN LIFE-HISTORY OF CERTAIN LITTLE-KNOWN APHIDIDAE.

BY CLARENCE MOORES WEED, COLUMBUS, OHIO.

I doubt whether our present knowledge of any of the larger families of American insects is in a more chaotic and deplorable state than that relating to the *aphididae*. Though much has been written concerning these insects, comparatively few species have been described in more than one or two of their several forms; and with a few notable exceptions, almost none of the authors who have described species have attempted to trace their seasonal life-histories. Doubtless this condition of things is due largely to the obscurity surrounding the subject, and the imperfect knowledge of the economy of the group both in this country and Europe, as well as to the difficulty of preserving specimens in satisfactory condition for study. The recent researches of Lichtenstein, and Kessler in Europe, and of Riley, Forbes, and others in this country, have given us, however, a substantial working basis for the tracing of the life-histories of these insects, and our knowledge ought hereafter to make more satisfactory progress.

This paper presents a part of the results of field work during the autumn of 1887 on species which have heretofore been very little studied, and about whose autumn life-histories nothing has been recorded. I am under obligations, for many favors received, to my co-workers in the Illinois State Laboratory of Natural History, especially to the Director, Prof. S. A. Forbes, under whose general instructions the investigations have been carried on.

## Aphis cornifoliae Fitch.

This species was first described by Dr. Fitch, in 1851, in the Fourth report of the regents of the University of New York (p. 65), from apterous females found on *Cornus paniculata*. The description is very brief, and as the date of collection is not given we have no means of knowing whether his specimens were oviparous or viviparous, though they were probably the latter. So far as I can learn the species has not since been recognized, except by Prof. Oestlund who says that it is rather

common on the dog-wood in Minnesota.* Whether the specimens described below belong to Fitch's species or not I can only conjecture, but as it is the only *Aphis* I have found upon this plant I refer it to this species.

My attention was first called to this insect by finding the winged viviparous females establishing colonies of sexed individuals on the leaves of dogwood about the middle of October. The insects had evidently migrated to the shrubs under observation either from other shrubs of the same kind or from some other kind of plant for there were no indications of their having developed where they were found. They occurred at the same time and in the same situations as *Schizoneura corni cola*. In fact the autumn life-history of the two species seems to be identical, except that the males of the latter are apterous while those of the former have wings. The eggs of the two species are laid in the same situations and are indistinguishable. Fully developed males and females were observed 24 October when some of the latter were ovipositing on the twigs; and all three forms were taken as late as 10 November.

*Winged viviparous female* ("*pseudogyna pupifera*†").

| | |
|---|---|
| Wing expanse | 6.40 mm. |
| Width of body | .68 mm. |
| Length of body | 1.83 mm. |
| " " antennae | 1.41 mm. |
| " " cornicles | .23 mm. |
| " " cauda | .11 mm. |

Head black, with frontal and post-ocular tubercles well developed. Prothorax black with prominent lateral tubercles. Meso- and metathorax black, somewhat shining. Abdomen green with a row of marginal sub-circular black spots, two transverse spots of same color on dorsum in front of cauda, and a similar quadrangular spot at anus, and just in front of it on ventrum; also occasional small scattered spots on both surfaces. Anterior legs dull yellowish-brown, with coxae, articulations of femora and tibiae, tips of tibiae, and tarsi, dusky. Middle and posterior legs same, except that femora are more or less dusky throughout. Cornicles long, blackish, cylindrical. Cauda dark yellowish-brown. Tegulae greenish-brown. Insertion of wings yellowish. Costal nervure blackish. Cubitus light yellow. Stigma blackish. Posterior nervures brown. Antennae long and slender. Joints I and II short, subequal; III nearly as long as IV + V, and slightly longer than VII; pores distinct; IV and V subequal; VI shorter than any except I and II; VII a little shorter than III. Rostrum yellowish-brown, reaching second coxae.

Described from six specimens taken 24 October 1887, on under side of leaves of *Cornus sanguinea* and *C. sericea*, with colonies of young of the oviparous form about them.

*Winged male.*

| | |
|---|---|
| Wing expanse | 5.00 mm. |
| Width across thorax. | 0.44 mm. |
| Length of body | 1.60 mm. |
| " " antennae | 1.20 mm. |
| " " cornicles | .14 mm. |
| " " cauda | .10 mm. |

* Fourteenth Rept. State geol. Minn., p. 47.

† Lichtenstein, "Les pucerons. Monographie des aphidiens," p. 150.

Head and thorax black; abdomen dull yellowish-brown, becoming black in older specimens. Eyes dark. Antennae dusky-brown; minutely tuberculous; with many pores. Joints I and II subequal in length; III longest, shorter than IV + V; IV and V subequal; VI about one-half as long as V; VII comparatively short, about equal to V, rough and not tapering, with two setae at tip. Cornicles long, dusky, cylindrical, roughened. Legs hairy; anterior pair yellowish-brown with coxae, articulation of femora and tibiae, tip of tibiae, and tarsi dusky; middle and posterior pairs yellowish brown, with coxae, band on middle of femora, tips of tibiae and tarsi dusky. Cauda broad, brown with curved stiff hairs on lateral and posterior margins. Rostrum reaching middle coxae, yellowish-brown. Tegulae yellowish-green; insertion of veins, costa, and cubitus yellowish-brown; stigma olive brown.

Described from two living specimens taken on leaf and twig of *Cornus sanguinea* 10 November 1887. The genital organs of one were exposed.

I have not been able to prove that these males develop along with the oviparous females from the migrating winged viviparous form, and would not be surprised if they were found to develop on the same plants as the latter, and fly to the colonies of the oviparous form, as has recently been proven to be the case with the hop plant-louse (*Phorodon humuli* Schrank).

*Oviparous female.*

| | |
|---|---|
| Length of body . . . | 1.30 mm. |
| Width of body . . . . | 0.63 mm. |
| Length of antennae . . | 0.57 mm. |
| " " cornicles . . | 0.06 mm. |
| " " cauda . . . | 0.08 mm. |

Green, with a glaucous bloom: somewhat flattened, widest at middle and tapering both ways. Cornicles and margin of cauda, dusky; sub-quadrangular dusky spot on anus. Eyes reddish-brown. Antennae slender, light yellowish-brown, with dusky tips; 6-jointed, I and II short, III long, IV two-thirds as long as III, filament long. Rostrum light yellowish-brown with dusky tip; reaching posterior coxae. Legs light yellowish-brown, tarsi with dusky tips; coxae greenish; posterior tibiae distinctly swollen. Cauda hairy.

Described from one specimen taken in act of ovipositing in axil of twig of *Cornus sanguinea*, 24 October 1887.

Of many other specimens examined the only perceptible difference was in the depth of coloring of the body, the older specimens becoming more or less brownish.

*Egg.*

Elongate oval. 0.95 mm. long, 0.23 wide. Green when first deposited but becoming black by exposure.

Described from a specimen just laid by the female mentioned above. Probably it would have shrunk some after being laid.

### Aphis sp. on Amarantus albus.

On 19 October 1887, I found a species of *Aphis* very abundant on a plant of *Amarantus albus* growing near one of the university barns. So far as I could see the species was rep-

resented only by wingless males and oviparous females, which abounded on the under surface of the leaves. Many pairs were mating, and many of the females were laying eggs on the under surface of the leaves, especially along the midrib. The eggs were of the normal form, light colored when first extruded and becoming dark on exposure. About a fortnight later when the plant had been killed by frost the aphides were abundant in the rubbish beneath the plant and some of them had penetrated the soil about the roots. Both forms were still abundant. A few had wandered to a neighboring plant of some species of *Polygonum.*

I find no mention of any aphid infesting *Amarantus albus* in this country, and as the plant is supposed to be naturalized from the tropics it probably does not occur in Europe. In Lichtenstein's* list of host-plants, in which are included all genera known to be infested by aphides, *Amarantus* is not mentioned. Of course this species may also occur on some other plant, but I have found nothing like it in extensive and careful collecting this fall. But although it is probable that the species is undescribed I prefer to leave it unnamed (at least until the other forms can be obtained) rather than run the risk of uselessly burdening the synonymy of the group.

*Wingless male.*

| | |
|---|---|
| Width of body . . . . | 0.50 mm. |
| Length of body . . . . | 1.10 mm. |
| " " antennae . . | 1.20 mm. |
| " " cornicles . . . | 0.08 mm. |

Flattened, long and narrow. General color black, mottled with green especially on thorax and abdomen. Head large, black, with a well developed frontal tubercle. Dorsum of thorax black with more or less green on margins. Dorsum of abdomen greenish black, more or less distinctly marked with black transverse patches, especially posteriorly. Cornicles, legs and eyes black. Legs very long with short stiff hairs. Antennae long, robust, roughened with tubercles which are quite large on basal joints, but smaller apically. Rostrum black, reaching cephalic margin of posterior coxae. Ventrum of thorax black, of abdomen green.

Described from one living specimen taken *in copula* on *Amarantus albus*, 19 October 1887.

*Oviparous female.*

| | |
|---|---|
| Width of body . . . . | 0.75 mm. |
| Length of body . . . . | 1.60 mm. |
| " " antennae . . | 0.50 mm. |
| " " cornicles . . . | 0.10 mm. |

Body green, with powdery white flocculence, head dusky. Antennae white with dusky tips, roughened by sparse minute tubercles tipped with fine short hairs. Legs whitish, with dusky coxae and tarsi, and more or less dusky on articulations; somewhat hairy. Cornicles nearly color of body. Eyes black. Anus and a quadrangular patch just in front on ventrum, dusky. Rostrum not quite reaching middle coxae; dusky at base and apex.

Described from one living specimen taken *in copula* on *Amarantus albus*, 20 October 1887.

*Les pucerons, p. 76-140.

Another specimen taken *in copula* on the same plant at the same time is slightly yellowish, and has the members (cornicles, antennae, and legs) nearly dusky throughout. A large number of other specimens examined did not differ materially from these two types.

SIPHONOPHORA RUDBECKIAE (FITCH).

This species was first described as *Aphis rudbeckiae* by Dr. Fitch in the Fourth report of the regents of the University of New York (1851, p. 66). The description is very brief and drawn up from winged specimens (said to be males) found upon *Rudbeckia laciniata*, *Solidago serotina* and *S. gigantea*. No dates of collection are given.

In the Proceedings of the Entomological society of Philadelphia for December, 1862 (vol. 1, p. 298) Mr. Walsh describes winged male and female specimens of an aphid found on *Silphium perfoliatum* and on an undetermined *Cirsium* which he doubtfully identifies as *Aphis rudbeckiae*. Certain discrepancies as to color between his specimens and those of Fitch are pointed out. No dates are given.

In Bulletin no. 2 of the Illinois State laboratory of natural history (1877, p. 4) Dr. Cyrus Thomas includes this species in his list of *aphidini* referring it however to the genus *Siphonophora*. The host plants mentioned are *Rudbeckia laciniata*, *Ambrosia trifida*, and *Solidago serotina*. No descriptions are given.

The species is next mentioned by Mr. J. Monell (Bull. U. S. geol. surv., vol. 5, p. 21), who records eleven host-plants, and remarks that the species is probably the commonest of all American aphidians. No life-history details are mentioned.

Again in the Eighth report of the state entomologist of Illinois (p. 49-50) Dr. Thomas gives a full description of the winged viviparous female (though whether the summer or autumn form we cannot tell) and records the occurrence of a green variety, but makes no mention of the sexed forms, nor of the method of hibernation.

The only other important mention of the species that has come to my notice is found in Professor O. W. Oestlund's recent list of the *aphididae* of Minnesota (op. cit., p. 20) where it is said to be found abundantly throughout the season on *Solidago serotina* and *Silphium perfoliatum*. In discussing the apterous males of an allied species (*S. frigidae* Oestlund) the author states: "Wingless males have been observed in both of the above mentioned species"—*S. rudbeckiae* and *S. ambrosiae*, but he describes neither of them, and omits to state whether the sex was ascertained by dissection or field observations. I describe below a winged male, of the sex of which there can be doubt, so that this is another species in which apterous and winged males have been observed. I watched carefully for apterous males but found none. It is to be hoped that in order to establish the fact beyond a doubt the two forms of this sex may be found in the same or adjoining colonies.

My observations upon the species began about the middle of October 1887, when I found the winged viviparous females (*pseudogyna pupifera*) establishing colonies of sexed individuals upon the leaves and stems of various *compositae*, especially, *Solidago* and *Lactuca*. Although the red specimens were by far the commoner, the green variety mentioned by Dr. Thomas was frequently seen. The first specimens seen *in copula* were taken on 18 October, and the first eggs were found on the stem of *Lactuca canadense* on 28 October, in company with oviparous females. On 9 November, a careful examination was made of many old plants which had previously been infested by the lice (as shown by the cast skins), but no living specimens nor eggs were found. The roots and the earth about the roots was also examined with like result. Two days later however the oviparous females were found abundantly on the under leaf-surface of many young plants of *Lactuca* and *Muhlenbergia*, where they were depositing eggs freely. Hence I concluded that the occurrence of eggs on the stems of old plants is exceptional, and that the normal habit of the species is to deposit the eggs on the young plants of such biennials or perennials as it infests.

*Winged viviparous female* (*pseudogyna pupifera*).

| | |
|---|---|
| Expanse of wings . . . . | 7.6 mm. |
| Width of body (across thorax) | 0.9 mm. |
| Length of body . . . . . . | 3.0 mm. |
| " " antennae . . . . | 3.2 mm. |
| " " cornicles . . . . | 1.0 mm. |
| " " cauda . . . . . | 0.3 mm. |

Head dark reddish-brown, shining. Prothorax of same color. Meso- and metathorax slightly darker, shining. Abdomen nearly black with a slight greenish tinge, shining. Ventral surface greenish black. Antennae long, tapering, black except basal joint, which is unicolorous with head; with rows of rather sparse hairs. Joint I short, large; II small; III long, tuberculate; IV and V subequal, each nearly as long as III; VI very short, about $\frac{1}{3}$ as long as V; VI-VII very long, slender. Legs long, hairy; distad of middle of femora brownish-black, proximad dull greenish- or yellowish-brown. Cornicles very long, black, cylindrical, with flange at tip. Cauda long, greenish. Rostrum greenish with dusky tip, reaching second coxae. Tegulae green. Insertion of veins yellowish green. Costa brown; cubitus yellowish; stigma greenish; other veins brown.

The depth of coloring of the body varies considerably. One specimen examined was very dark, another quite light.

Described from two specimens taken on *Lactuca canadense* 25 October 1887, establishing colonies of young.

*Winged male.*

| | |
|---|---|
| Wing expanse . . . . | 6.8 mm. |
| Width of body . . . . | 0.8 mm. |
| Length of body . . . . | 2.4 mm. |
| " " antennae . . . | 4.0 mm. |
| " " cornicles . . | 0.4 mm. |
| " " cauda . . . . | 0.2 mm. |

Dull yellowish-brown, slightly darker on dorsum of thorax and central parts of ventrum. Antennae black, slightly brownish at base. Legs very long, black, except coxae, trochanters

and proximal portions of tibiae yellowish. Cauda long. Cornicles long, black, contracted at middle, dilated at tip. Basal wing-veins and tegulae light yellowish. Beak reaching posterior coxae, yellow at base, becoming brownish toward apex.

Described from one specimen taken *in copula* on *Solidago*, 18 October 1887.

*Oviparous female.*

| | | |
|---|---|---|
| Width of body . . . . | 1.2 | mm. |
| Length of body . . . . | 3.0 | mm. |
| " " antennae . . | 4.0 | mm. |
| " " cornicles . . | 0.7 | mm. |
| " " cauda . . . | 2.5 | mm. |

Above clear reddish-brown, slightly darker on thorax. Cauda light yellow, with a few rather long hairs. Cornicles black, long, large at base and slightly tapering apically. Antennae blackish, very long, with sparse stiff hairs. Under surface much like upper. Rostrum dark brown, reaching to anterior margin of posterior coxae. Legs very long; coxae unicolorous with under surface; femora and tibiae light brown (very much lighter than body) with black tips; tarsi black. Abdomen large.

Described from one specimen (having ten well developed eggs in the abdomen) taken on *Lactuca* or *Mulgedium*, 22 October 1887.

### Schizoneura cornicola (Walsh).

Whether the species described by Walsh under the above name is the same as the European *Schizoneura corni*, or not, I cannot tell, nor am I certain that the forms described below are the same as those found by Walsh, whose description (Proc. Ent. soc. Phil., vol. 1, p. 304) is brief and was drawn up from dried specimens. There is every probability, however, that they are the same. Walsh doubtfully refers the species to the genus *Eriosoma*, and states that "numerous [winged ?] individuals unaccompanied by any flocculent matter, and so far as I recollect by larvae, occurred in September, on the lower side of the leaves of the red osier dogwood."

Thomas quotes Walsh's note and refers the species to *Schizoneura*, but does not mention having seen the insect.

My observations upon the species began about the middle of October, 1887, when winged viviparous females were abundant upon the under surface of the leaves of *Cornus sanguinea* and *C. sericea*, and were just beginning to establish colonies. No other form was present, which led me to think that these winged individuals had migrated from some other species of plant, as had they been developed on *Cornus* there would probably have been indications of it — either cast skins or belated colonies. These winged individuals were occasionally seen upon other plants, but their presence was evidently accidental, as none of them were establishing colonies.

On 24 October, the dogwood leaves were covered with colonies of the three forms, — winged viviparous females (*pseudogyna pupifera*), apterous males, and oviparous

females. Many of the latter were mating, and some of the oviparous females had begun to deposit eggs on the twigs about the buds. From this time on the winged individuals became less numerous until, by 11 November, they were only rarely found. At the latter date, however, many of the males and females were still on the leaves and twigs.

*Winged viviparous female* (*pseudogyna pupifera*).

| | | |
|---|---|---|
| Expanse of wings . . . | 6 | mm. |
| Length of body . . . | 2 | mm. |
| Width of body . . . . | 8 | mm. |
| Length of antennae . . | 9 | mm. |

Black above, except anterior and lateral margins of abdomen, and in many specimens more or less of posterior portion. Beneath black, except prothorax and abdomen (save a black patch in front of anus) which are dull, whitish-brown. Rostrum black, except a more or less distinct lighter patch near base, hairy, reaching posterior coxae. Legs robust, black, except a short, brownish space at base of anterior femora; thickly provided with brown hairs. Antennae robust, beset with brown hairs. Joints I and II, short, smooth; III, long, with row of tubercles on its outer ventro-lateral surface; IV and V subequal, with tubercles as on III; VI, a little longer than V, excavated on its outer lateral surface about two-thirds distance from base. Wing veins mostly brown. Stigma brownish, with interior portion darker.

Described from many specimens taken 24 October 1887, on leaves of *Cornus sanguinea* and *C. sericea*, where for some time previous they had been very numerous, founding sexed colonies. Usually occurring on the under surface.

*Apterous male.*

| | |
|---|---|
| Width of body . . . . | 0.05 mm. |
| Length of body . . . . | 0.89 mm. |
| Length of antennae . . | 0.47 mm. |

Body and members, brownish or brownish-black, with numerous brown hairs. Eyes black. Body flattened, long and narrow, with nearly parallel sides. Antennae half as long as body. Joint I, short, swollen; II, small; III, longest; IV and V, subequal; the latter excavated on its apical lateral surface. Legs long, robust, same color as body. Rostrum robust, reaching anterior margin of posterior coxae.

Described from several living specimens (part taken in *copula*), from *Cornus sericea*, collected 24 October 1887.

*Oviparous female.*

| | | |
|---|---|---|
| Width of body . . . | 0.50 | mm. |
| Length of body . . . | 1.14 | mm. |
| Length of antennæ . . | 0.35 | mm. |

Green, or greenish-brown, slightly darker anteriorly. Shape, elongate-oval; sparsely clothed with brown hairs. Eyes blackish. Antennae green, slightly darker apically; joint III longest, V slightly swollen in middle. Rostrum robust, green, darker at tip, reaching anterior margin of posterior coxæ. Legs unicolorous with body, dusky apically.

*Egg.*

Elongate oval, 0.56 mm. long, 0.2 wide.

Green at first, becoming black by exposure. Deposited on bark, in and about the axils of buds and small branches.

Described from many specimens on *Cornus sericea*, 24 October 1887.

CALLIPTERUS DISCOLOR. MONELL.

This handsome species was described by Mr. Monell, in 1879, from winged specimens found in Missouri, on the under side of the leaves of *Quercus bicolor*, in May. So far as I know it has not since been treated of.

I first noticed the species about the middle of October, when winged viviparous females were establishing colonies of sexed individuals on the under surface of the leaves of the bur-oak (*Quercus macrocarpa* Mx.) on the university farm. I was unable to describe this form at once, and when I next visited the trees, 28 October, only the sexed individuals were present.

As noted below, the eggs are deposited on the leaves, and very likely the young hatch in spring and crawl upon the twigs before the leaves fall, as it is well known that many oak leaves, especially on young trees, do not drop until quite late in spring.

*Winged male.*

| | |
|---|---|
| Expanse of wings . . . . . , . | 2.60 mm. |
| Width of body (across prothorax) | 0.45 mm. |
| Width of body ( " mesothorax) | 0.65 mm. |
| Length of body . . . . . . . . | 2.00 mm. |
| Length of antennae . . . . . . | 1.35 mm. |

Light yellow, with black markings. Head above subtriangular, black. Pronotum black, with an oblique yellowish line on each side near the margin, and a transverse line (interrupted by two black spots) on the posterior margin. Meso- and metanotum, black, with a yellow stripe on each margin. Dorsum of abdomen, yellow, with a series of transverse dark stripes along the middle, a row of dark spots on each lateral margin, and numerous smaller scattered spots on its surface. Ventral surface of head dusky green; of prothorax, yellowish; of meso- and metathorax, dark green; of abdomen, yellowish, with transverse dark stripes, especially towards anus. Eyes red. Rostrum reaching slightly caudad of caudal margin of anterior coxae; greenish-yellow with base dusky. Legs yellowish, more or less dusky, with fine hairs. Antennae dusky brown or black, darker apically, long and tapering. Joints I and II subequal in length, I being larger transversely; III long; IV two-thirds as long as III; V slightly shorter than IV; VI and VII subequal, both shorter than V; VII slender. Membrane of wing, whitish. Tegulae and basal portion of veins, yellowish. Wing-veins brownish black, with more or less clouding of the membrane along their margins, especially where they terminate. Stigma wide, dusky at lateral and caudal margins, but whitish in middle and front.

Described from three living specimens taken on under leaf-surface of *Quercus macrocarpa*, 29 October 1887.

The depth of coloring of the body and members varies considerably with the age of the specimen.

This form is developed along with the oviparous female on the leaves of various oaks. Late in October 1887, I examined great numbers of colonies and frequently saw the pupae of this winged form on the leaves; and in several instances I saw the winged adults emerging from the pupa-skin.

*Oviparous female.*

| | |
|---|---|
| Length of body . . . . . . . | 2.00 mm. |
| Width of body (above anterior coxae) | 0.50 mm. |
| " " " (above middle coxae) | 0.74 mm. |
| " " " (across middle of abdomen) . . . . . . . . . | 1.00 mm. |
| Antennae . . . . . . . . . . | 1.20 mm. |
| Cornicles . . . . . . . . . . | 0.05 mm. |

Light yellow; dorsum with four longitudinal rows of mostly subquadrangular spots of a yellowish-brown color, two of the rows being on the lateral margins, and the other two on each side the meson. On the abdomen are various smaller spots of the same color. Under surface immaculate. Body provided with numerous rather long brown hairs, having slightly enlarged truncate tips, distribution on dorsum corresponding to that of the colored spots. Head and prothorax subquadrangular; former with a small tubercle surmounted by a hair in front on each side of the meson. At posterior margin of prothorax body suddenly widens and expands to middle of abdomen, when it begins to contract posteriorly and ends in a long tapering ovipositor. Cornicles yellow, short, large. Eyes yellow, with a red spot on their lower surface. Antennae slender, tapering, yellowish-brown with dusky articulations and tips. Joints I and II as usual; III very long, equal to IV + V; IV and V subequal; VI short, half as long as V; VII also short, slightly longer than VI. Legs robust, dusky yellowish-brown, with many short hairs. Tarsi black. Rostrum short, reaching just back of anterior coxae, yellow, with black tips.

Described from three living specimens from *Quercus macrocarpa*, 27 October 1887.

The depth of coloring of this form varies much. Many specimens have a distinct reddish tinge, others are more or less brownish, and still others (apparently those which have recently passed the last moult) are green. The depth of color of the members varies with that of the body —those specimens which are green having legs and antennae also more or less green, those which are brown having legs and antennae brownish, etc.

*Egg.*

Elongate, subcylindrical; 0.47 mm. long, 0.17 mm. wide. Green or yellowish when first deposited, but becoming darker on exposure. Deposited by the side of the midrib or secondary vein on the under surface of the leaf, stuck in among the long leaf hairs.

Described from two specimens taken on leaf of *Quercus macrocarpa*, 28 October 1887.

The long ovipositor of the female no doubt aids greatly in inserting the egg in its proper position close to the midrib

among the dense pubescence that covers the under leaf surface. If the abdomen terminated as does that of those species which oviposit on bark, the egg would often be caught on the ends of the hairs and blown away.

In order to determine the numbers of eggs laid by a single female I crushed several specimens in alcohol on a glass slide and counted the number of well developed eggs contained within the abdomen. The greatest number found was 25, and the least 10; the other specimens containing 10, 13, 10, 20, 15, 11 and 13 respectively.

CHAITOPHORUS VIMINALIS Monell (?).

Mr. J. Monell has described,* under the name *Chaitophorus viminalis* wingless and winged specimens of a plant louse on *Salix lucida* and *S. babylonica*. No dates are given but probably both these forms were viviparous.

Late in October I found sexed individuals of a species of *Chaitophorus* abundant on some bushes of *Salix alba* in the university arboretum. It was evidently too late for the viviparous forms, as none were found. Hence I refer these specimens to *viminalis* with some hesitancy. They are not *C. smithiae*, however, as the nectaries are short and thick, and Monell states that in the latter they are long and flaring at the tip, a character which places the species (*smithiae*) in the genus *Cladobius*.

*Winged male.*

| | |
|---|---|
| Expanse of wings . . . | 4.3 mm. |
| Width of body . . . . | 0.6 mm. |
| Length of body . . . | 1.50 mm. |
| " antennae . . | 1.15 mm. |
| " cornicles . . | 0.05 mm. |
| " cauda . . . | 0.08 mm. |

Black, somewhat shining; abdomen greenish-black. Body and members furnished with rather long brown hairs. Antennae black, except base of third joint which is brownish, with a few long brown hairs. Joints I and II subequal; III long, not quite equal to IV + V; IV and V subequal; VI short, rather thick; VII long, slender, nearly three times as long as VI. Cornicles short, greenish-brown. Rostrum reaching slightly back of anterior coxae, greenish black. Legs blackish, with tibiae pale brown. Cauda broad, expanding from base to middle. Wing membrane whitish. Tegulae and base of wing-veins yellowish-brown, as are the costa and cubitus; stigma, and other veins brownish-black.

Described from one living specimen taken on under leaf-surface of *Salix alba*, 3 October 1887. Genital organs were extruded.

*Oviparous female.*

| | |
|---|---|
| Length of body . . . . | 16.5 mm. |
| Width of body . . . . | 0.9 mm. |

Dull yellowish-brown or blackish. Body and appendages furnished with numerous long brown hairs. Eyes dark. Antennae dusky brown or blackish, robust. Joints I and II subequal; III shorter than IV + V; IV slightly longer than V, which is slightly longer than VI; VII rather thick, slightly longer than III. Legs robust, dusky yellowish-brown or blackish. Rostrum robust, unicolorous with body, reach-

*Bull. U. S. geol. surv., vol. 5, p. 31.

ing anterior margin of posterior coxae. Cornicles very short, unicolorous with body.

Described from many specimens taken in company with young, and winged males on under leaf-surface of *Salix alba*, 31 October, 1887.

*Egg.*

Oval; 0.6 mm. long, 0.3 mm. wide. Yellow when first extruded. The only specimens seen were deposited on the under leaf-surface, but I surmise that they may be usually deposited about the buds, though after considerable search I have found none so placed.

Described from five specimens taken, together with oviparous females, on the under leaf surface of *Salix alba*, 8 November 1887.

## THE PIONEER PAINTER OF NORTH AMERICAN INSECTS.

BY HERMANN AUGUST HAGNE, CAMBRIDGE, MASS.

Marc Catesby was born in 1679 or 1680 and died 23 Dec. 1749, at London. His early inclination to study natural history was much suppressed by his residing remote from London, I do not know where. Having relatives in Virginia he decided to go there, to study plants and animals foreign to England. He arrived there 23 April 1712 and returned to England in 1719. By generous friends he was induced and urged to go again to America, and arrived 23 May 1722, at Charleston, S. Carolina. He employed the first year collecting, describing and figuring plants and animals. After living nearly three years in Carolina, Georgia and Florida he went to the Bahamas, visiting Providence and some adjacent islands. As he was not bred a painter he asks indulgence for some faults in his pictures. Returning to England in 1726 and wishing to publish the result of his labors he tried to teach himself the art of etching. As far as I understand the notices given in the preface of his book (out of which are taken the above facts) he colored the plates himself. He was a Fellow of the Royal society. It is today rather difficult to understand how the publication of such an expensive work was at all possible, as the list of the subscribers contains only 165 names. He was induced by his patrons to study the birds rather than describe promiscuously insects, and other animals. Therefore he was not able to delineate a great number of insects. Those given are, as far as I know, the first North American insects figured after living specimens and published colored. The figures are recognizable, though sometimes not good. The descriptions are short and prove that he was not an entomologist. Nevertheless the work of a pioneer should not be entirely forgotten.

Below I give the title and a list of the insects figured: The natural history of

Carolina, Florida and the Bahama Islands . . . by Marc Catesby. London, Innys, fol. Vol. 1, 1731; Vol. 2, 1743, tab. 200. Appendix 1748; tab. 20.

Edition 2 by George Edwards. London, 1754.

" 3 by George Edwards. London, 1771.

Vol. 1. pl. 8 Gryllotalpa columbia Scudd.
35 Ecpantheria oculatissima S. & A.
66 A fly; not recognizable.

Vol. 2. pl. 83 Papilio turnus Linn.
84 Attacus luna Linn.
86 " cecropia Linn. and cocoon.
88 Danaus plexippus Linn.
89 Oedipoda carolina De Geer.
90 Attacus cecropia Linn.
91 A. polpyhemus Cram.
94 Eacles imperialis Drury. Larva.
95 Thais rumina Linn.
96 Deiopeia bella Linn.
97 Papilio turnus Linn.
100 " marcellus B. & L.

Appdx. pl. 4 Thalessa atrata Fabr.
5 Pelopoeus caeruleus Linn.
10 f. 3 Pulex penetrans Linn.
4 A beetle I have not been able to identify.
5 Blatta americana Linn.
9 " ? not known to me.
7 Silpha peltata Catesby.
11 Canthon laevis Drury. Phanaeus carnifex Linn.
13 Sphex cementaria Drury.
15 Mutilla coccinea Fabr.?

## NOTES ON THE LARVAL STAGES OF SAMIA CYNTHIA.

BY CAROLINE G. SOULE, BROOKLINE, MASS.

The eggs of *Cynthia*, except a very few, did not turn green before hatching. Those laid first, 10th May, hatched on 31st May, giving 21 days for the egg-period; but those laid last, 18th May, hatched on 3d June, giving 16 days for this period.

The larvae ate very little till the middle of the second day, and did not eat the egg-shell at all, unless they ate the bits removed to let them out.

When very young they seemed to be troubled by the excrement, which clung to the anal shield, instead of dropping in the usual manner, and the larvae had a way of seizing the excreta with their mouths, pulling them free, and then giving them a quick jerk which threw them over the edge of the leaf. There was a little silk visible all through the first stage, where the larvae moved.

About 120 eggs I gave away, of the remaining 221 only two failed to hatch.

I gave most of the larvae tulip-tree (*Liriodendron tulipifera*), leaves, which they ate eagerly.

With some I tried lilac, pear, *Pyrus-japonica*, walnut, and horse-chestnut, and at first they seemed to like them, except the horse-chestnut, but the second day they only nibbled at these leaves, and several larvae died.

To others I gave *Lonicera tartarica* and bittersweet (*Solanum dulcamara*,) and these they ate fairly well, but did not grow as large as those on tulip-tree, though they moulted at the same times.

Moulting began on 7th June, seven days from the hatching of the first eggs.

The second moulting of the first-born larvae began on 9th June, only two days from the first moulting, and before the last larvae had finished their first moulting.

The 3rd moulting began 14th June, five days from the second, and before the last larvae had accomplished their second moulting.

The 4th moulting began on 17th June, before the last larvae had finished the 3rd moulting. The green color appeared for the first time, and the anal shield was bright orange edged with pale blue. Several died in moulting, and for no apparent cause.

On the night of 30th June two larvae began spinning, and by four P. M. on 1st July their cocoons were thick, while several others had begun to spin, making their larval life just one month.

The largest of these laıvae weighed ¼ oz. each and were three inches long, or lacked a trifle of that length. The smallest, those fed on *Lonicera tartarica* were one and a quarter inches long and weighed very little—less than my letter-scales would weigh; their moults corresponded with those of the full-grown larvae, and they reached the same coloring and markings, except the orange anal shield, with the blue edge, and the other blue markings.

Their development seemed to be retarded as well as their size stunted by the food-plant.

Although the dwarfs moulted at the same time with the large larvae of the same age, the two which survived the last moult fed until the last part of July, when one died, and the other began to spin 31st July. After various futile attempts he gave it up, and, on 8th Aug., pupated on the bottom of the tin, without any trace of silk about him. The pupa was bright yellow, turning brown gradually.

None of the larvae fed on tulip-tree made as heavy cocoons as those fed on *Ailanthus*, from which these were bred.

PSYCHE.

CAMBRIDGE, MASS., NOV.-DEC., 1888.

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## TWO EUROPEAN WEEVILS NEW TO THE UNITED STATES.

Mr. F. C. Bowditch has collected *Sciaphilus muricatus* and *Strophosomus coryli* in Brookline, Massachusetts. Thirteen specimens of the first mentioned species were beaten from balm of gilead, *Populus balsamifera*, and about the same number of *Strophosomus coryli* were obtained by sifting. Sometime ago Mr. H. B. Bailey sent me, for identification, four specimens of *S. coryli* which he had collected on yellow birch, *Betula lutea*, at South Orange, N. J. In Europe this species has been recorded from birch (*Betula*), beech (*Fagus*), hazel (*Corylus*), oak (*Quercus*), pine (*Pinus*), and the Scotch broom (*Cytisus scoparius*). Dr. W. G. Dietz identified the species for Mr. Bowditch.

*Samuel Henshaw.*

## HIBERNATION OF THECLIDI.

How many of our *Theclidi* pass the winter in the egg state? Last year I found a wintering egg of *liparops* on a shadbush (*Amelanchier canadensis*), and this year that of *titus* on wild cherry in each case in a protected spot on one of the terminal twigs. Several species of European *Theclidi*, at least five or six of the nine species, are reported to winter as eggs, while of the others perhaps one or two winter as chrysalids. Mr. Saunders, then of London, now of Ottawa, years ago obtained the caterpillars of *acadica* and *edwardsii* in June before any butterfly is on the wing, so that it is probable that these species also winter in the egg; and Mr. Hulbert, of New Britain, last year found caterpillars of *calanus* during the last of May, so that that species is presumably also in the same category. But I should be glad of further facts regarding them. On the other hand *damon* (*smilacis*) certainly winters as a chrysalis, and probably all the species of *Incisalia*, *I. augustus*, *niphon* and *irus*, to judge from their early appearance only. How is it with *melinus*? I suspect this also winters in the chrysalis state, but should be glad of any information that can be given.

*Samuel H. Scudder.*

## REARING LEPIDOPTERA.

In the early times of my entomological work I found much difficulty in obtaining moths from pupae formed "in the ground"—as represented by kegs, deep flower-pots, &c. Three or four years ago I accidentally hit upon a much easier and more successful way of obtaining such pupae, and imagines. A *Sphinx drupiferarum* larva was forgotten in a close tin, and pupated perfectly without a particle of earth. After finding this pupa, Miss Eliot and I experimented with other *sphingidae*, *Datana ministra*, *Anisota senatoria* and other larvae, with the result that of those we allowed to pupate in the ground more than half failed to give the imago, while of those pupating in the close tins very few failed.—Of some kinds every one emerged. With one or two exceptions all those in tin emerged earlier than those in earth, though kept in the same room.

As this plan has been in successful operation for three or four years, and is much simpler and easier than the earth-plan, I venture to recommend it "to all whom it may concern."

*Caroline G. Soule.*

## PROCEEDINGS OF SOCIETIES.

### CAMBRIDGE ENTOMOLOGICAL CLUB.

(*Continued from p. 70.*)

12 Nov. 1886.—The 123d meeting of the club was held at 61 Sacramento St., Cambridge, 12 Nov., 1886. In the absence of the president, Mr. S: H. Scudder was chosen chairman. The secretary announced the withdrawal from the club of Mr. Thaddeus William Harris. As Mr. Harris was a member of the executive committee a ballot was taken and Dr. George Dimmock elected to fill the vacancy.

Dr. G: Dimmock read a letter from Mrs. M. L. Owen, of Springfield, with reference to a curious case, exhibited a few meetings ago, which resembled that of one of the trap-door spiders.

He then showed specimens of what appeared to be a wingless species of *chalcidae* from Cambridge, and also a specimen of *Grapta interrogationis*, with its chrysalis, which emerged 10 Nov.

Mr. S: H. Scudder showed a photograph of Dr. Asa Fitch taken from an ambrotype.

Mr. Scudder then read a letter from Miss Adele M. Fielde, in which she described some of her observations on insects in China.

He then exhibited drawings of *Papilio philenor* and *P. chalcas*, by Mr. J. H. Emerton.

10 Dec., 1886.—The 124th meeting was held at 61 Sacramento St., Cambridge. In the absence of the president, Mr. S: H. Scudder was chosen chairman.

The Secretary announced the withdrawal from the club of Mr. G: H. Parker.

Nomination no. 143, that of Mr. Paul Howard Cheney of Cambridge, for active membership was presented by Messrs. Child and Dimmock.

Dr. G: Dimmock read a paper on the "Reproduction of lost limbs in Coleoptera," in which he gave a somewhat detailed account of experiments which he had tried of amputating the legs of larvae of *coccinellidae* and the subsequent reproduction of these limbs. The paper was prefaced by an account of what had been recorded by previous observers upon the reproduction of lost limbs in insects, and will be published in full in *Psyche*.

Mr. S: H. Scudder remarked upon an article by Graber in which that author arrives at the conclusion that the antennae are the only organs sensitive to smell.

He then read extracts from Plateau's "Une expérience sur la fonction des antennes chez la blatte" in which he concludes that the palpi as well as the antennae are capable of the perception of odors.

Mr. Scudder then showed "The butterflies of India," by G. F. L. Marshall and de Nicéville, and briefly reviewed the work.

14 January 1887.—The 125th meeting (11th annual meeting since incorporation) was held at 61 Sacramento St., Cambridge, 14 January 1887. In the absence of the President, Dr. G: Dimmock was elected to the chair.

The annual report of the secretary, treasurer and librarian were presented and accepted, that of the treasurer having been previously examined and approved by the auditors.

The librarian reported 207 accessions to the library for the year 1886, making the total number of accessions 1562.

Nomination no. 143 was acted on and Mr. Paul Howard Cheney elected to active membership.

The club next passed to the election of officers for 1887, which resulted in the election of the following: president, J. H. Emerton; secretary, Roland Hayward; treasurer, B. Pickman Mann; librarian. G: Dimmock; members at large of executive committee, George Dimmock and S: H Scudder.

Mr. B: Pickman Mann was chosen editor of *Psyche*, with power to choose his associates.

The annual address of the president, Prof. S. A. Forbes, was presented by the secretary. The address was upon "The present state of our knowledge concerning contagious insect diseases." (See *Psyche*, v. 5, p. 3-12.)

Mr. S: H. Scudder then showed some plates from a work which he has in preparation upon our New England butterflies.

11 FEB. 1887.—The 126th meeting was held at 61 Sacramento St, Cambridge, 11 Feb., 1887. The meeting was called to order at 8 P. M., the president, Mr. J. H. Emerton in the chair. Nine members were present.

The secretary, in behalf of the executive committee, stated that a contract had been drawn up between the club, as party of the first part, and Mr. B: Pickman Mann, as party of the second part. Under this contract, Mr. Mann was to assume the publication of *Psyche*. The contract was then read, accepted, and the secretary authorized to act as assistant treasurer as per contract.

The secretary was empowered to levy an extra assessment of fifty cents on all resident members.

Mr. S: H. Scudder read a paper on the injuries to plants by white ants. Maple trees have been quite seriously injured by *Termes flavipes*. Mr. Scudder found many of the geranium cuttings in a greenhouse attached to Mt. Auburn cemetery injured by these depredations. The white ants enter the cut end and eat away all but the rind. They have there just the conditions which they most need. Mr. Scudder recommends, as a preventative, that the trays in which the cuttings are placed should be lined with slate tiles. (See *Can. entom.*, v. 19, p. 217-218.)

Mr. S: H. Scudder exhibited under the microscope some of the androconia or scales peculiar to the male sex, which are found in the *hesperidae*. These occur in one or two places on the fore wing, according to which of the two groups into which he has divided the skippers they belong. In one of these groups, the *hesperidi*, comprising most of the larger skippers, they are found in a special overlapping fold of the wing membrane, on the costal border; in the other, the *pamphilidi*, into which the bulk of the smaller species fall, in a surface dash crossing the base of the median nervules. In the interior of each is the mass of slender, more or less thread-like scales, which in our New England *hesperidi* take the form of curving or chain-like, slender, twisted ribbons, or thread-tipped, tapering scales; the homologous structures of the *pamphilidi* are the pointed scales or short pile forming the velvety interior of the discal streak. Outside of all, and partially or wholly concealing the others, are the large tenuous cover-scales, many times larger than the ordinary scales of the wing, with entire margin and concave or tortuous surface. While along the edges of the fold of the *hesperidi*, or in definite spots about the stigma of the *pamphilidi*, are two other sets of scales—a modification of those found along the veins of the costal area—slender, nearly uniform, one, two, or three-toothed, and generally of a very dark color; and secondly, the very minute boat-shaped scales, which are apparently intermingled indefinitely with the others.

The identity of the elements which characterize these two forms of male adornment in the skippers has not before been recognized, but there is an additional and independent character in the *pamphilidi* in the frequent presence below the area of the dash proper of a large patch of partially erect fan-like scales.

Mr. Scudder also called attention to the difference between the New England species of *Thanaos* without pre-marginal white spots on the fore-wing and the others, in that the curving hairs of the interior of the costal fold are replaced in the former: in one case, *brizo*, by twisted ribbon-like scales; and in the other, *icelus*, by thread-tipped, tapering scales, very different in general appearance from the curving hairs and wholly lacking the basal crook of these. (See *Psyche* v. 5. p. 86-88.) Remarks were made by various members.

Mr. S: H. Scudder then exhibited the inflated larvae of various diurnal lepidoptera.

Dr. G: Dimmock showed a living plant-louse, *Siphonophora pelargonii* hatched 2 Feb., which had neary completed its full growth.

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*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name, as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic; G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

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Synoptic table of the genera of *chalcidinae*. G: D. (4625)

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Table of genera, of which two new (*dasyglenes*, *brachycrepis*) are described; describes 3 new species. G: D. (4626)

**Braswell**, A. List of the butterflies collected at Chapel Hill, N. C. (Journ. Elisha Mitchell scientific society, Jan.-June 1888, v. 5, p. 19-21.)

List of 69 species and varieties of diurnal lepidoptera taken at Chapel Hill, N. C. G: D. (4627)

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Discusses the homological relationship between tracheae and and veins in the wings of insects. G: D. (4628)

**Brehme**, Hermann H. *Arzama obliquata*, G. and R. (Can. entom.. Sept. 1888, v. 20, p. 180.)

Discusses place of pupation of *arzama obliquata*. G: D. (4629)

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Monograph of the *stenopelmatidae* and *gryllacrididae*; gives general remarks on characteristics of the groups, external anatomy, mode of life; synopses of the genera and species; describes 11 new species of *stenopelmatidae* from North America, belonging to the genera *stenopelmatus* (6), *schoenobates* (1), *glaphyrosoma*, n. g. (1), *gammarotettix*, n. g. (1), *ceuthophilus* (2); describes 7 new species of *gryllacridae* belonging to the genera *gryllacris* (4), *dibelona*, n. g. (1), *neortus*, n. g. (1). G: D. (4630)

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Brief account of *anthrenus scrophulariae* and its ravages, with means used against it; from Boston *Transcript*. G: D. (4631)

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**C.**, J. Smell and hearing in moths. (Nature, 15 Nov. 1877, v. 17, p. 45, 8 cm.)

Moths not very sensitive to the odor of ammonia, but quite so to sound. G: D. (4633)

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Considers hearing a poorly differentiated sense and smell a well differentiated one in insects. G: D. (4634)

**Cecil**, H: Hearing in insects. (Nature, 6 Dec. 1877, v. 17, p. 102, 4 cm.)

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**Easton**, N. S. Caddis-flies construct new cases. (Swiss cross, June 1888, v. 3, p. 191, 3 cm.)

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Enumeration of species of North American coleoptera found in nests of *formicidae*, with notes on their habits. *G: D.* (4655)

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Notes swarm of insects "resembling winged ants" in Watkins, N. Y. *G: D.* (4692)

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List of 85 species of North American *sphingidae*. *G: D.* (4694)

**Smith**, J: B. [Self-acting collecting-apparatus.] (Entom. amer., Aug. 1888, v. 4, p. 86.)

Quotation, with comments, of a description of a self-acting apparatus for separating insects from siftings, from Entom. zeitung . . . zu Stettin, 1887, v. 48, p. 314. *G: D.* (4695)

**Smith**, J: B. William W. Hill. (Entom. amer., Mar. 1888, v. 3, p. 235-236.)

Biographical sketch of W: W. Hill, lepidopterist; b. 19 Sept. 1833, d. 28 Jan. 1888. *G: D.* (4696)

**Spraying** Bartlett pears. (Cult. and country gent., 6 Sept. 1888, v. 53, p. 666, col. 1-2, 35 cm., 2 fig.) (Sci. amer., 22 Sept. 1888, v. 59, p. 182, col. 3, 18 cm.)

Mode of spraying pear-trees with arsenical insecticides. *G: D.* (4697)

## ENTOMOLOGICAL ITEMS.

Two suggestions to Students of Entomology—Some years ago we used the following method for studying the venation of the wings of small lepidoptera. We have told it since to many friends, but believe it has not been published. It is in some respects preferable to the so-called "Dimmock process" and particularly as a time-saver. It is also in this respect preferable to denudation with a brush. The wing is removed and mounted upon a slide in Canada balsam, which should be preferably rather thick. The slide is then held over the flame of an alcohol lamp until the balsam spreads well over the wing. Just as it is about to enter the veins, however, the slide is placed on ice, or, if in the winter time, outside the window for a few moments. This thickens the balsam immediately and prevents it from entering the veins, which remain permanently filled with air and appear black with transmitted light. With a little practice one soon becomes expert enough to remove the slide and cool it at just the right time, when the scales will have been rendered nearly transparent, by the balsam while the veins remain filled with air. We have done this satisfactorily not only with *tortricidae* and *tineidae*, but with noctuids of the size of *Aletia* and *Leucania*. The mounts are permanent, and we have some which have remained unchanged since 1880. Professor Riley had for some years before this been in the habit of mounting wings in balsam, in which, of course, the scales cleared after a time. With aphids and coccids, which are covered with an abundant waxy secretion which can not be readily brushed away, we have adopted the plan of melting the wax. We place the insect on a bit of platinum foil and pass it once over the flame of the alcohol lamp. The wax melts at a surprisingly low temperature and leaves the insect perfectly clean for study. This method is particularly of use in the removal of the waxy cocoon of the pupae of male *coccidae*, and is quicker and more thorough than the use of any of the chemical wax solvents which we have tried. L. O. Howard, *in Insect Life*, Nov., 1888, p. 151-152.

Habits of Termites.—Mr. P. H. Dudley, in an article read before the New York microscopical society and published in its Journal for July 1888, describes some of the habits of white ants, especially of those found on the Isthmus of Panama. He writes of a slide of woody fibre, or pulp, from a termites' nest:

"The wood has been so thoroughly comminuted, that it is doubtful whether it could be recognized as woody particles under the microscope, unaided by chemical reagents.

"A study of similar slides throws some light upon their work of destruction on many kinds of wood, in structures.

"The particles of wood do not have as sharp, angular corners as one would naturally expect of chips cut from solid wood; on the other hand, they seem as tho made from softened wood, or that undergoing decay. The particles have more the appearance of little pellets than cuttings, which in some measure is doubtless due to the form, motion and pressure of the mandibles. After they are cut the next step is not clear. Some cuttings serve as food for the insects, as they are found in the alimentary canal. Others are mixed with some substance which causes the particles to adhere, and then are fashioned into the walls, which form the galleries of the nest.

"The walls are built up of a number of thin layers of the cuttings, give evidence of being prepared with great care, and become quite hard and solid. A fragment thrown into water does not disintegrate by soaking, and after many hours it requires trituration to separate the particles.

"On turning a piece, nearly all of the substance is consumed; the residuum, however, being much more than the natural ash of the wood—some clay is present. Phloroglucin gives a reaction, showing some lignin is still in the woody particles. In many of the specimens I found fragments of the mycelium of a fungus, and upon examining the stick of yellow pine, 6×11 inches, which contained the nest, found it was in process of decay at the point of attack." . . .

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No. 149-150 were issued 9 Nov., 1888.

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 153.**

JANUARY 1889.

*CONTENTS:*



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

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Having accumulated a very large stock of references to the literature of many subjects of knowledge (and especially of entomology), I will furnish references on special subjects at ten cents each. (See PSYCHE for Oct.-Dec. 1884, v. 4, p. 223). Circulars giving further details sent on demand.

B: PICKMAN MANN,
Washington, D.C.

*LIBRARY OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.*

The librarian of the Cambridge Entomological Club calls attention to the desirability of preserving in the library of the Club as complete a series of entomological publications as it is possible to collect. It is especially desirable to preserve the transient literature of the subject—separates, small pamphlets and newspaper articles—and the librarian will be pleased to receive single copies of the daily papers, scientific journals, magazines, or agricultural papers, which contain entomological articles. These papers are preserved and catalogd, and, because they are overlooked by large general libraries, are just the kind of material that should be preserved in a special entomological library. Any one who has sought for some of the best of the agricultural journals of the western states in libraries will appreciate any effort made to preserve journals of this sort.

Separates which are often thrown into the waste-basket, as useless, as too small for preservation, as duplications of parts of serials, or as valueless, are respectfully solicited. The friends of the Club are also asked to send a copy of newspapers in which they have published articles or notes on entomological subjects. If these notes are anonymous, the author's name will be acceptible information.

The accessions to the library of the Club had reached the number of 1643 at the end of last year (1887).

Direct all papers for the library to

CAMBRIDGE ENTOMOLOGICAL CLUB,
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# NOTES ON PROTECTIVE RESEMBLANCE IN SPIDERS.

BY GEORGE F. ATKINSON, COLUMBIA, S. C.

A very interesting case of unintentional mimicry by *Argiope riparia* came to my notice a few years ago. A villager in western North Carolina found a web of this species in his garden. He was struck by the peculiar zig-zag line across the web and imagined he could read WAR! WAR!! WAR!!! It attracted considerable attention among the inhabitants of the town. A notice of this was published in the village paper and copied in several of the state papers. It created considerable consternation among the superstitious ones of the inhabitants, who regarded the portents of war with fear. It is interesting to reflect how, if ignorance and superstition belonged to our people as to some of the peoples of ancient countries, this incident might have given us a "*Sacred* spider," and thus afforded it the protection which these gods were wont to receive.

Beside the case mentioned by Hentz* where *Synemosyna formica* resembled ants when crawling on the blades of grass and corn, I have frequently noticed this species (probably the same) running on the bare ground in the hot sun, in roads and paths, mimicking almost to perfection certain of the smaller members of the *mutillidae*.

*Tetragnatha* frequently mimics elongated dark blotches on grass stems. I have often seen them, when frightened, leave their web and clinging to a grass stem place their bodies close to the stem, stretch their anterior legs above, and their posterior ones below. The body being dark and the legs green, the spider was well protected.

*Thomisus celer* remains principally on yellow flowers, and once I found a greenish variety of this species on golden-rod (*Solidago*), the flowers of which, not yet open, were greenish.

The pellets made of silk and bits of leaves, and hung in a row on the web of *Epeira caudata*, in many cases have proportionately more or less of the dark and white intermingled, according as the dark and white spots on the spider predominate.

In the case of *Acrosoma spinea*, which makes an oblique web and hangs on the underside of this, the white dor-

*Spiders of the U. S., p. 73.

sum against the light of the sky as a background might afford it a protection from enemies below; and the dark of the venter against the dark background of the earth, a protection from those above it.

Many such cases can be regarded more clearly as protective since we now know that insects probably do not see *form*, but *color* and *movement*.

## DESCRIPTION OF EGGS AND LARVA OF APATELODES TORREFACTA.

BY CAROLINE G. SOULE, BROOKLINE, MASS.

A female found at Nonquitt, Mass., on 13 July 1888, laid a mass of pale green eggs, circular, flat on both top and bottom, translucent, and looking like tiny gelatine lozenges, 1.5 mm. in diameter. 20 July, the embryo could be seen — with a lens. Five days later the eggs had become opaque and of a sordid yellowish white color. 26 July, the young larvae hatched, being a trifle less than 6 mm. long, covered with long white hairs, and having a few dark ones near the head and the anal shield.

The head, body, feet, and props were pale yellow, without marks.

The hair was dense, long over the anal end, shorter over the middle, and still longer on first three segments. The body became green with food. The larvae rested on both sides of the sassafras (*Sassafras officinale*) and ash (*Fraxinus*) leaves, and moved *very* fast. A slight jar sufficed to make them fall from the leaf and drop by a silken thread.

When touched they curled up like the arctians. They drank greedily, and ate cast skins.

Those Miss Ida M. Eliot had ate beach-plum (*Prunus maritima*) and oak (*Quercus*).

Some sent to Miss Emily M. Norton ate wild-cherry (*Prunus*).

2 Aug. The larvae molted, becoming even whiter and "fluffier" than before, with a dorsal line of black dashes, and a dark pencil on the tenth segment. A few had gray hairs over the head.

5 Aug. They molted for the second time;—as before with the addition of a gray pencil on the second and third segments.

Feet and props were conspicuously white.

10 Aug. Third molt. 25 mm. long, body green; feet and props white; head sordid white; hair very long and silky, and from each dorsal dash sprung a short black pencil.

A lateral and subventral line of black arrow-heads appeared.

One larva became bright yellow with the pencils tan-colored with black tips, and one was of a soft gray with black pencils.

15 Aug. Fourth molt.

The venter was black, and the props were black with white tips. On first and second segments, the arrow-heads were replaced by vertical black dashes, extending nearly to the dorsal line.

The yellow one came out with the body black, the hair Maltese-gray, lighter over the head; pencils darker gray with black tips. The gray one was like it.

26 Aug. Adult larva, 51 mm. long, densely covered with long silky hair—varying in color from pure white to deep gray. Pencils almost black with black tips. Head gray.

Body hardly to be seen but black wherever visible. Props black with red tips. Feet black.

27 Aug. Three shed all their pencils and long hair, emptied themselves, and crawled rapidly about as if hunting for good places to pupate. Rotten wood and bark were provided, but no attention was paid to them, and no signs of spinning were found.

30 Aug. The pupae appeared, bright apple green, with three abdominal rows of gray dots, at first, but they soon became of a uniform mahogany color, very shining and bright, about 19 mm. long.

Some were in close tins, and some in a paste-board box, but those in tin pupated first.

The larvae fed on sassafras grew faster and larger than those fed on ash, and molted and pupated earlier.

As the larvae grew older they chose older leaves, in preference to young and tender ones, as food.

This I have noticed with all my larvae this year.

## ELECTRIC LIGHT CAPTURES.

BY JOHN HAMILTON, ALLEGHENY, PA.

The reputed rarity of an insect is frequently owing to its ability to conceal itself and a want of knowledge in the collector regarding its habits, whereas it may be really abundant. This is exemplified in the instances of *Calosoma scrutator* and *C. willcoxi*. During near twenty years of collecting here I only took a single living specimen of each; Mr. Klages who has collected near half that time — and carefully, was not more successful, nor were several amateurs whose collections were seen. Yet all this time there were thousands of these insects about us as we now know. This year (1888) the evenings of 9, 10 and 11 May were warm, temperature 60° to 65° F. During one hour of each of these evenings I picked up from the platform of an open pavilion in one of our parks in the centre of the city, to the corners of which powerful electric lights were suspended, ninety ♀ and thirty ♂ *Calosoma scrutator;* one hundred and ten ♀ and twenty-six ♂ *C. willcoxi*. Three weeks of low tem-

perature and great humidity succeeded during which time no beetles were observed, but on 2 June it became warm again and so continued, and these same beetles again occurred, but much less abundantly, and continued till 23 June, after which no more were observed. Mr. Klages collected during a few evenings at the electric lights suspended opposite the large plate-glass windows of some of the stores in Pittsburgh with such success, that he sent to Europe seven hundred specimens of *C. willcoxi* and three hundred of *C. scrutator* (his correspondents there write for more!).

Where these beetles came from is a matter of speculation, but it is scarcely supposable that all were raised in the city. The number of individuals must have been immense as the collecting done by Mr. Klages and myself was only at a few places, and for a very brief period, and that in face of the small boy, etc., etc., difficulty. Of *Calosoma calidum*, which has always been moderately abundant, not over a dozen specimens were taken at light the whole season. *C. externum* yielded five specimens, *Diplochila major* four specimens, *Polymoechus brevipes* six specimens, *Erycus puncticollis* four specimens, none of which had been taken elsewhere.

To show the great distances to which water beetles fly, I may state that at the same place on the evenings of May mentioned I picked up twenty-three ♀ and four ♂ *Cybister fimbriolatus*, one ♂ *Dytiscus fasciventris*, twenty-four ♀ and seven ♂ *Hydrophilus triangularis*. The great hemipteron, *Belostoma americanum* could have been taken by the peck. The nearest point to the river is more than three-fourths of a mile.

The number of coleoptera and insects of all orders that are attracted to the electric lights in these cities is beyond computation.

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## EFFECT OF CONSANGUINITY IN LEPIDOPTERA.

The late M. Pierre Millière contributed an article, entitled, "Des résultats variés que donnent chez les lépidoptères les accouplements consanguins," to *Il naturalista siciliano* for May 1887, which contains facts interesting to the biologist. He writes:

"When, among lepidoptera bred in captivity, pairings continue from one generation to another, without interrupting the series of consanguineous unions by the introduction of new blood, there occurs for each species a particular result, in such manner that the consanguineous and successive unions not only do not produce, for the lepidoptera in general, identical results, but, on the contrary, each species conforms to an influence which is peculiar to itself."

As illustrating this variety of effect of consanguineous unions in lepidoptera the author obtained fertile eggs for two successive years from *Hadena solieri;* the third year only about half the eggs hatched, while the fourth

year, of an abundance of eggs from different females, none hatched. Ninety eggs of *Spilosoma zatima*, obtained after a consanguineous union failed to hatch. Of *Crocallis dardoinaria*, which has a single annual brood, the first year 480 eggs, and the second year about 500 eggs, all proved fertile, but the third year not an egg hatched out of a large number obtained.

*Eucrostis indigenata* and *Cidaria vittata* failed to produce fertile eggs with consanguineous parents.

He adds: "On the contrary *Nemoria aureliaria* raised in captivity, has not, during more than ten years, ceased to be fertile, both for spring and fall generations."

"I could multiply these examples, but the facts which I give suffice to show the interest which pertains, from the point of view of the establishment of specific characters for lepidoptera, to the verifying that, in each species, the continuance of the reproductive power varies when the pairings are between consanguineous individuals and without the introduction of new blood.

As *Crocallis*, *Eucrostis*, *Cidaria*, and *Nemoria* all belong to the *geometridae*, the variability of reproductiveness in close-breeding in a single family is very marked. Experiments on such biological subjects need multiplication. *G: Dimmock.*

## PACKARD'S "ENTOMOLOGY FOR BEGINNERS."

In A. S. Packard's "Entomology for beginners" appears, for the first time from an American publisher, possibly the first time in the English language, a work on general entomology which presents the subject in accordance with modern scientific progress. Instead of being a systematical classification and enumeration of insects to which the study of their anatomy, physiology, and biology is subordinated or appended, as is generally the case with entomological works, the systematic part of this work occupies only about one-third of its pages, and is sprinkled with allusions to habits, and to internal as well as to external anatomy. The great number of species of insects make it necessary to fill a larger proportion of the work with details of classification than would be the case in considering any other division of the animal kingdom. The chapter devoted to "insects injurious and beneficial to agriculture" is short, but contains as many details, proportionally to the size of the whole book, as seems necessary in a general entomological work.

Of special importance and value are the chapters devoted to modes of collecting, preserving, and rearing insects; to their dissection; and to the cutting and mounting of sections of insects, whole insects, or their organs, for microscopical study. Here Professor Packard has brought together a good number of methods from widely separated sources. The directions for dissection and for microscopical research must prove very useful to the younger students in America who are beginning to turn their attention from unwieldy entomological collections to the comparative anatomy and histology of insects. At first reading of Professor Packard's work, I was inclined to believe that these methods should have been revised and more thoroughly combined in his work, but a second examination convinced me that the nearer each description retained the words of the originator of the process the better, leaving the student or investigator to select for himself the method or parts of methods best suited to his special requirements.

The list of periodicals and works on entomology which occupies ten pages, near the end of the work, is well selected, but there is a lack of uniformity in typographical matters in this list, and in the numerous bibliographical references in the body of the work. Slight inaccuracies of statement are noticeable in places in the work, which is not wonderful when its scope and extent are considered, but it will prove most useful not only to beginners but to all entomologists.

*G: Dimmock.*

# PSYCHE.

CAMBRIDGE, MASS., JANUARY 1889.

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## INACCURATE FIGURE OF A BUTTERFLY'S EGG.

I have always wondered where the figure of the egg of the vanessid butterfly *polychloros* of Europe came from, as it was manifestly incorrect, although it has been extensively copied, and so far as I know, never found fault with. Dr. Riley has just lent me the volumes of Sepp's Nederlandsche Insecten, and there I find the culprit. It is figured as having the shape of a pear or perhaps better of a gourd, being much constricted and produced at the top. In Sepp's other figures of eggs which are laid in batches, the clusters are figured likewise, as for instance in the case of *urticae*, but here this is not done, and I am strongly under the impression that Sepp, whose accuracy is well known, must have mistaken the egg of some other insect for that of *polychloros*, the eggs of which are laid in clusters and resemble those of *antiopa*, both in their manner of deposition and in their form, so closely that they can hardly be distinguished.

*S: H. Scudder.*

## MACULATION AND PUPATION OF SMERINTHUS EXCAECATUS.

In Lexington, Mass., 17 Aug. 1888, I confined a large female *Smerinthus excaecatus* in a breeding cage. In a few hours she began to lay, attaching, singly or in small clusters, some eighty roundish, light-green eggs to the netting with which the cage was covered. I then removed them to a glass jar, to prevent the escape of the young larvae—should they hatch—through the meshes of the netting. On 25 Aug. the eggs began to hatch, and the larvae ate freely of willow (*Salix*), with which I supplied them. The first molt was taking place 2 Sept., and the second 11 Sept. Up to this time I had noticed no red spots, but after this they appeared on less than one-half of the specimens then alive. As is the case amongst most of the *sphingidae*, I believe, while young, the mortality of my *S. geminatus* and *S. excaecatus* has been great, so that at the completion of their second molt less than half had survived, though I had taken much pains to keep their jar clean and well supplied with fresh twigs of willow.

The red spots, besides being present in only a part of my specimens, were unequally distributed in these, some having both the stigmatal and dorsal, while others had only the stigmatal spots.

About 25 Sept. the greater part of these larvae stopped eating and settled to rest in the bottom of their jar. As they were apparently very far from being fully grown, having reached a size perhaps half or two-thirds of that which should normally be attained by these larvae, I was disinclined to consider their behavior a preliminary to pupating. After a few hours, however, to my great surprise, they pupated, forming of course very small chrysalids. The interesting question in regard to these larvae is this:— did I overlook two molts, owing to the habit that this larva has of eating all of its cast-off skin but the head, or did they pupate when they had accomplished only two of their orthodox number of molts? The former supposition seems to be rendered unlikely from the fact that at the time of pupating they were so far from having attained their normal size, not to speak of the improbability

of two molts escaping my frequent and somewhat careful scrutiny. The latter supposition seems to be favored by the circumstance of the lateness of the season when the parent moth was taken, as it is rare to find one so late as 17 Aug. Several of the pupae soon sickened and, on being handled. readily collapsed, showing that they lacked the robustness of normal specimens.

As to the distribution of the red spots, I find. on consulting William Buckler's work "The larvae of the British butterflies and moths," that the three British specimens of the genus *Smerinthus* (*S. ocellatus*, *S. populi*, and *S. tiliae*), all show the same disparity as does our *S. excaecatus* in regard to number and distribution.

*Holmes Hinkley.*

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## PROCEEDINGS OF SOCIETIES.

### CAMBRIDGE ENTOMOLOGICAL CLUB.

(*Continued from p. 139.*)

11 March 1887.—The 127th meeting was held at 61 Sacramento St., Cambridge, 11 March 1887. The meeting was called to order shortly after eight, the president, Mr. J. H. Emerton in the chair.

The additions to the library were announced by the librarian.

Mr. S: H. Scudder exhibited specimens of *Melitaea harrisii* which had been kept in a cyanide bottle since June 1886 and called attention to the curious fading of the black in the wings.

He then showed a photograph of Major John LeConte taken from a miniature.

Mr. Scudder read a letter dated 16 January, 1887, from Miss Adele M. Fielde of Swatow, China, containing six larvae. These were found "on the level surface of the coarse sand which covers the bottom of an aqueduct, under an inch or two of fresh, clear, running water; little structures which resembled a tiny cave with a gray gauze awning stretched in front. They were to be seen in scores, always opening up stream, the gauzy entrance arched at the top and having a span of an eighth to half an inch. There was usually a buttress of sand in the rear, which in some cases had been swept away. The largest of the larvae found was five-eighths of an inch long. It burrowed in the sand, forming the floor of its cave, and stretched its head out of its furrow, appearing to feed on what had been caught in the delicate roof of its den. Its head and the three thoracic segments, each of which bore a pair of jointed legs, were a glossy reddish-brown, while the following eight segments were, in some specimens bright green, in others opaque gray. The terminal portion, a translucent white segment, bore two cylindrical prongs, ending in a tuft of long setae and having a brown hook on the under side, like the hooks on the feet. Nine segments, beginning with the mesothoracic, bore on the ventral surface tracheal gills, which issued from the body in a single stem and then branched irregularly into finger-shaped processes. The arrangement of these gills is much like that of the setae on the ventral surface of the earthworm, as far as I could discover without a dissecting microscope. in four longitudinal rows. The two outer ones being the larger. (I am not certain whether there were really four rows or whether the branching gave the appearance of four rows.) No antennae were visible. The eyes are small and close to the mouth. The metathoracic appears to coalesce with the first abdominal segment, but differs in color. There are many may fly larvae flitting about the little structures, probably uninvited guests at the banquet spread out in the net of their host. The species is probably allied to one described by Miss Cora H. Clarke."

(See Proc. acad. nat. sci., Phil. 1888, p. 129-130, pl. 8.)

Mr. S: H. Scudder then showed figures of the fossil butterflies known from America.

Mr. W: Trelease exhibited specimens which he supposed to belong to some species of *coccidae*.

## BIBLIOGRAPHICAL RECORD.

*Authors and societies are requested to forward their works to the editors as soon as published. The date of publication, given in brackets [], marks the time at which the work was received, unless an earlier date of publication is known to recorder or editor. Unless otherwise stated each record is made directly from the work that is noticed.*

*A colon after initial designates the most common given name, as: A: Augustus; B: Benjamin; C: Charles; D: David; E: Edward; F: Frederic; G: George; H: Henry; I: Isaac; J: John; K: Karl; L: Louis; M: Mark; N: Nicholas; O: Otto; P: Peter; R: Richard; S: Samuel; T: Thomas; W: William. The initials at the end of each record, or note, are those of the recorder.*

*Corrections of errors and notices of omissions are solicited.*

**Atkinson**, G: F. New instances of protective resemblance in spiders. (Amer. naturalist, June 1888, v. 22, p. 545-546.) (Journ. Elisha Mitchell sci. soc., Jan.-June 1888, v. 5, p. 28-30.)

*Thomisus aleatoreus*, at rest, imitates with its anterior legs spikelets of grass; *cyrtarachne multilineata*, a new species here described, mimics shells of *helix*. *G: D* (4698)

**Atkinson**, G: F. Note on the tube-inhabiting spider, *lycosa fatifera* Hentz. (Amer. naturalist, June 1888, v. 22, p. 546-547.) (Journ. Elisha Mitchell sci. soc., Jan.-June 1888, v. 5, p. 30-31.)

On the use of its tube by *lycosa fatifera*. *G: D.* (4699)

**California** — *Board of state horticultural commissioners.* First report. Sacramento, *state office*, 1882. t. p. cover, 94 p., 24×15, t 18.5×11.2. il.

CONTENTS: Officers and members of boards of state viticultural, and of state horticultural commissioners; acts of legislature and quarantine rules of viticultural and horticultural commissioners, for protection of fruit-growing industries of the state; minutes of proceedings of Board of state horticultural commissioners, and minutes of first annual horticultural convention, both series of minutes containing notes on measures against noxious insects; papers (recorded separately under authors' names) by S. F. Chapin, Matthew Cooke, Ellwood Cooper, C: H. Dwinelle, Felix Gillet, W. B. West, and E. J. Wickson. *G: D.* (4700)

**Cockerell**, Theodore Dru Alison. The orange spot in *nathalis iole*, Bdw [!]. (Can. entom., Aug. 1888, v. 20, p. 156-157.)

States that the orange spot on the wings of *nathalis iole* is liable to fade suddenly. *G: D.* (4701)

**Field**, E: H. History of a brood of lunas. (Swiss cross, Aug. 1888, v. 4, p. 46-47, 45 cm.)

Account of rearing *attacus luna*; description of different stages. *G: D.* (4702)

**French**, G: Hazen. Partial preparatory stages of *catocala innubens*, Guen. (Can. entom., Sept. 1888, v. 20, p. 170-172.)

Describes larva and chrysalis of *catocala innubens*. *G: D.* (4703)

**Gauckler**, H. Lepidopterologische notizen. (Societas entom., 15 Feb. 1886, v. 2, p. 171, 23 cm.)

Contains notice of a pupa of *sphinx pinastri* with a deformed proboscis-sheath, which produced an imago with deformed proboscis. *G: D.* (4704)

**Handlirsch**, Anton. [Die variabilität und die geographische verbreitung der hummeln.] (Verh. K.-k. zool.-botan. gesells. in Wien, 1888, v. 38; Sitz.-ber., p. 34-36.)

Discusses the geographical distribution of the species of *bombus*, and the variability of the species. *G: D.* (4705)

**Harrach**, M. Ueber den fang von ameisengästen und deren vorkommen bei den verschiedenen ameisenarten. (Entom. zeitschr., 1888, v. 2: 1 May, p. 14-16, 85 cm.; 1 June. p. 25-26, 70 cm.)

Mode of collecting myrmecophilous coleoptera, and notes on species found in nests of different species of *formicidae*. *G: D.* (4706)

**Landois**, Hermann. Beobachtung über den verbleib des spinnfadens. (Jahresber. d. Westfäl. provinzial.-vereins für wissensch. u. kunst für 1885, 1886, p. 30.)

The author believes that spiders eat their thread when they reascend it and it disappears. *G: D.* (4707)

**Monell**, Joseph. A new genus of *aphidae*. (Can. entom., June 1877, v. 9, p. 102-103.) [Rec., 1183.]

Reprint. (Valley naturalist, Jan. 1878, v. 1, p. 2, col. 1, 15 cm.)

Describes *colopha*, a new genus of *aphididae*, for *byrsocrypta ulmicola*, Fitch; literature of the species. *G: D.* (4708)

**Ormerod**, Eleanor A. Parasites of the "hessian fly" (*cecidomyia destructor*, Say). (Entomologist, Dec. 1887, v. 20, p. 317-318.)

From the parasites of *cecidomyia destructor* in England being Russian, the author concludes that England probably received its *cecidomyia* from the east. *G: D.* (4709)

**Peckham**, G: W. *and* **Peckham**, Elizabeth Gifford. On duration of memory in wasps. (Amer. nat., Nov. 1887, v. 21, p. 1038-1040.)

Separate. 1887. p. 1038-1040. 24×15, t 18×10.2.

Results of experiments to find how long specimens of *vespa maculata* remembered the location of their nests. *G: D.* (4710)

**Peckham**, Elizabeth (Gifford), *wife of* G: W., *see* PECKHAM, G: W.

**Stokes**, Alfred C. An old Dutch microscopist and what he did. II. Some of his discoveries. (Swiss cross, July 1888, v. 4, p. 1-3, 70 cm.)

Figures magnified foot of spider, and scales of some insects: describes these and other things seen by Leeuwenhoek. *G: D.* (4711)

**Tracy**, Mary E. New Jersey butterflies. (Swiss cross, July 1888, v. 4, p. 31, 4 cm.)

List of diurnal lepidoptera seen in April 1888, in Plainfield, N. J. *G: D.* (4712)

VON **Varendorff**, O. Ein käferfang im winter auf dem eise. (Societas entom., 1888, v. 3: 1 May, p. 20, 31 cm.; 15 May, p. 28, 22 cm.)

Mode of collecting beetles on the ice. *G: D.* (4713)

**Venus**, C. Eduard. Ueber varietäten-zucht. (Corresp.-blatt d. Entom. ver. "Iris" zu Dresden, July 1888, v. 1, no. 5, p. 209-210.)

Negative results of experiments upon heterophagic variation of lepidoptera; success in producing variation in *vanessa urticae* by rearing in increased temperature. *G: D.* (4714)

**Veron**, E. Ueber parthenogenesis bei *bombyx mori*. (Zool. anzeiger, 14 May 1888, v. 11, p. 263-264.)

Denies that parthenogensis is possible in *bombyx mori*. *G: D.* (4715)

**Voeltzkow**, Alfred. Vorläufige mittheilung über die entwicklung im ei von *musca vomitoria*. (Zool. anzeiger, 7 May 1888, v. 11, p. 235-236.)

Brief outline of the development of *musca vomitoria* in the egg. *G: D.* (4716)

**Waters**, G: Franklin. Peculiar cocoons. (Swiss cross, June, 1888, v. 3, p. 190, 14 cm.)

Figures a peculiar cocoon of *attacus promethea*. *G: D.* (4717)

**Waters**, G: Franklin. [Sense of taste in birds.] (Proc. Bost. soc. nat. hist., Oct. 1883, v. 22, p. 433-434.)

Abstract, by C: Copineau, entitled, "Remarques sur le sens du gout chez les oiseaux." (Bull. Soc. linn du nord de la France, Feb. 1887, v. 7, p. 219-221.)

A sparrow hawk [*tinunculus sparverius*] is stated to have eaten earth worms [*lumbricus*] and to have developed a taste for caterpillars. *G: D.* (4718)

**Webb**, Sydney. The elucidation of causes of variation. (Entomologist, Mar. 1888, v. 21, p. 87-89.)

Urges entomologists to keep more complete accounts of meteorology, soil and subsoil, in localities where varieties are taken. *G: D.* (4719)

**Weir**, J: Jenner. On melanism. (Entomologist, Apr. 1887, v. 20, p. 85-87.

Defends Lord Walsingham's [T: DeGrey's] view that "dark coloration of lepidoptera from both high latitudes and altitudes was of service to them, because in such localities 'they require rapidly to take advantage of transient gleams of sunshine.'" *G: D.* (4720)

**Weniger**, J. Adolphe. On the sexes of lepidopterous larvae. (Entomologist, Apr. 1887, v. 20, p. 87-88, 2 fig.)

Describes a mode of distinguishing males from females in the later larval stages of some species of *attacus* (e. g., *a. cecropia*); comments on this method by E: B. Poulton follow (p. 88-89). *G: D.* (4721)

**White**, W: The effect of meteorological conditions upon insect-life. (Entomologist, Sept. 1888, v. 21, p. 217-220.)

Discusses probable effect of the cold, moist weather of July, 1888, in the production of melanic lepidoptera. *G: D.* (4722)

**Winston**, Eugenia. Wasp and cricket. (Swiss cross, Feb. 1888, v. 3, p. 63, 8 cm.)

Mode in which a wasp drew a cricket into a hole in the ground. *G: D.* (4723)

**Wood-Mason**, James. Some account of the 'palan byoo' or 'teindoung bo' (*paraponyx oryzalis*), a lepidopterous insect-pest of the rice-plant in Burma, which in the caterpillar state breathes water by means of tracheal gills. Calcutta, *gov't*, 1885. t.-p. + 12 p., 1 pl. 25 × 16, t. 16 × 10,cl.

Describes and figures the larva, pupa and cocoon of *paraponyx oryzalis* a new species of *pyralidae* infesting rice (*oryza*) in Burma; the larva is aquatic and breathes with tracheal gills, the position and nature of which are described. *G: D.* (4724)

**Woodworth**, C: [W:] *Leucanium hispidum* [!]. (Amer. florist. 1 Dec. 1886. v. 2, p. 149, col. 1, 26 cm.)

Brief account of the habits of *lecanium hesperidum* [corr.] and of the use of kerosene emulsion for its destruction. *G: D.* (4725)

## ENTOMOLOGICAL ITEMS.

NECROLOGY. — Since our last necrological notice (PSYCHE, Mar. 1888, v. 5, p. 36-36), news has been received of the death of the following entomologists, or persons who have contributed to, entomological literature: Dr. Guiseppe Bellonci, professor of anatomy in the university of Bologna, d. at Bologna, 1 July 1888, 30 years old. Dr. John Thomas Boswell (formerly known as Dr. Boswell Syme), lepidopterist, d. at Balmuto, Fifeshire, Scotland, 31 Jan. 1888, aged 66. Charles Donckier de Donceel, a well-known Belgian lepidopterist, d. 29 June 1888, at Chératte, near Liège, in his 86th year. Miss M. E. Glanville, economic entomologist, curator of the Albany museum, Graham's Town, South Africa, d. 4 April 1888. Philip Henry Gosse, naturalist, b. at Worcester, Engl., 6 April 1810, d. 23 Aug. 1888, at St. Mary Church, Torquay, England. Asa Gray, professor of botany in Harvard university, who has written numerous articles on fertilization of plants by insects, b. 18 Nov. 1810, in Paris, Oneida co., N. Y., d. 30 Jan. 1888, in Cambridge, Mass. William W. Hill, lepidopterist, of Albany, N.Y., b. 19 Sept. 1833, at Pittsfield, Mass., d. 28 Jan. 1888, at Elizabethtown, Essex co., N. Y. Johann Kriesch, professor of zoology in the Polytechnicum at Budapest, Hungary, and editor of the *Ungarische Bienenzeitung*, d. at Budapest, 21 Oct. 1888, 54 years old. Count August Friedrich Marschall, author of a "Nomenclator zoologicus" and writer on orthoptera, b. 10 Dec. 1804, d. 11 Oct. 1887, at Obermeidling, Austria. Jules Émile Planchon, botanist and student of phylloxera, b. at Ganges, dept. of Hérault, France, in March 1823, d. at Paris, France, 3 April 1888. Henry James Stovin Pryer, a well-known student of the entomology of Japan, b. near Finsbury Square, London, England, 10 June 1850; d. at Yokohama, Japan, 17 Feb. 1888, of bronchial pneumonia. John Scott, writer on hemiptera, b. at Morpeth, England, 21 Sept. 1823, d. in the same town, 30 Aug. 1888. George Robert Waterhouse, coleopterist (father of Charles Owen Waterhouse, also coleopterist), b. at Somers Town, England, 6 March 1810, d. at Putney, Engl., 21 Jan. 1888. *G: D.*

AGRICULTURAL EXPERIMENT STATION REPORTS. — The Cambridge Entomological Club desires to obtain as full sets as possible of all the reports of state experiment stations established under the Hatch bill, in so far as these reports contain entomological matter. Up to the time of writing the librarian has received bulletins from the states indicated by an asterisk below. For the benefit of our subscribers we append a list, as accurate as we can now make it, of the addresses of those stations that have entomologists. We should be glad to receive additions and corrections for this list.

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| N. Y. | Prof. J: H: Comstock, Ithaca. |
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No. 151-152 were issued 12 Dec. 1888.

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 154-155.**

FEBRUARY-MARCH 1889.

*CONTENTS:*



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

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PSYCHE.

# ON THE OCCURRENCE OF ORGANS PROBABLY OF TASTE IN THE EPIPHARYNX OF THE MECAPTERA (PANORPA AND BOREUS).

BY ALPHEUS SPRING PACKARD, PROVIDENCE, R. I.

From the observations of Meinert, Forel, Kraepelin and Will anatomical and experimental proofs have been afforded of the existence of organs of taste on the parts of the maxillae near the mouth, and also on the lingua or "tongue" of ants, wasps and bees; while Lubbock, in his recent excellent work "On the senses," etc. of animals, claims that the organs discovered by Wolff in the mouth-parts of the lower hymenoptera, e.g., *tenthredinidae*, *evaniidae*, *chalcididae* and *proctotrupidae* are also those of taste.

I have observed organs such as Will[1] describes and figures (his figs. 1, 8, 8a, 9, 11, 16, etc.), which he calls "geschmacksbecher" and Lubbock translates as "taste-cups," in the mounted preparations of the mouth-parts of the honey bee and a species of *Bombus*, kindly loaned me by Mr. N. N. Mason, of Providence. In the honey bee they are most abundant in the paraglossae situated at the base of the tongue and at the end of the furrow. Each paraglossa bears about 22-27 taste-cups, in my specimen 22 on the left, and 27 on the right paraglossa; on the inside, near the base of each labial palpus, and opposite the middle of the paraglossae are situated a group of exactly similar taste-cups, which are, however, rather like pegs than sunken cups or pits; they are protected in front by a few defensive spinules; and there are about 30 on each side.

In the *Bombus*, the left paraglossa bears about 28 taste-pegs arranged in irregular oblique rows; on the right are 28. On the base of the labial palpi, the taste-cups are less peg-shaped, more like cups, the rods being shorter and smaller while the rim of the cup is more marked. The terminal joint of the maxillae of *Vespa maculata* have no taste-cups, but about 35 taste-rods, which are much longer than those of *Vespa vulgaris* figured by Will.

I have also observed the taste-cups in the epipharynx of the honey bee.

*Taste-cups on the epipharynx of*

[1] Das geschmacksorgan der insecten. (Zeitschrift für wissensch. zool., 1885 v. 42, p. 674.)

*Panorpa debilis* Westw?, *and Boreus californicus* Pack.—Having thus become in a degree familiar with the organs so clearly described and figured by Will, I was prepared to look for them in other insects. It was not until I had found them in the epipharynx of *Panorpa* and *Boreus*, that I was aware that other observers had already noticed them. In his historical summary Will states that G. Joseph[2] in 1877 mentions that in almost all orders of insects, but especially in those living on plants, we find at the base of the tongue, in the region of the throat and the palate, little cups, which should be regarded as organs of taste. Künckel and Gazagnaire[3] (1881) found in *Volucella* similar organs on the paraglossae (labella), on the end of the epipharynx and at the beginning as well as throughout the whole extent of the pharynx. Will does not seem to have seen the elaborate plates of these authors in the second part of their great work on *Volucella*, where the mouth-parts of *Volucella*[4] are beautifully figured by Gazagnaire with numerous figures of microscopic sections of the proboscis and of the epipharynx and hypopharynx, including excellent histological details showing the gustatory cups, cells and nerves. The taste-cups we have seen in the insects mentioned below are similar to those figured by Gazagnaire, and, judging by their appearance and position where the fluids enter the mouth, there seems little doubt that these pits or cups, with their projecting rods or fine setae are true organs of taste.

Our own observations are very superficial, no attempt having been made to study the parts histologically, or by microscopic sections, so as to work out the nerves and ganglion cells. We have simply dissected out the parts, placed them for a few minutes in a mixture of carbolic acid, 1 part, and oil of turpentine 4 parts, with a drop or two of dilute liquor potassae. This clears the parts, rendering them transparent, so that they can be at once placed in the animalcule-box and examined under the microscope.

A word or two as to the homologies of the epipharynx may not be out of place. Little attention has been paid to the nature of this organ, and it is most desirable that a careful and comparative study of it be made. Morphologically it is the pharyngeal lining of the labrum and clypeus, and seems to be present in all insects. In the higher lepidoptera (macros) what has been regarded as the labrum is called by Dr. A. Walter[5] the epipharynx. In the hymenoptera it forms a short fold situated under the projecting labrum. What in the mecaptera

[2] Joseph, Gust. Zur morphologie des geschmacksorganes bei insekten. (Amtlicher bericht der 50. Versammlung deutscher naturforscher u. Ärzte in München, 1877, p. 227-228.)

[3] Du siège de la gustation chez les insectes dipteres. Constitution anatomique et physiologique de l'épipharynx et l' hypopharynx. (Comptes rendus, 1881, v. 95, p. 347-350.)

[4] Recherches sur l'organization et le développement des diptères et en particulaire des volucelles de la famille des syphides, part 1, 1875, part 2. 1881, only the plates and their explanations.

[5] Walter, Alfred. Beiträge zur morphologie der schmetterlinge. 1er theil. Zur morphologie der schmetterlingsmundtheile. (Jena. zeitschr., 1885, v. 18, n. s., v. 9.)

we call the parepipharynx is apparently the pale, non-chitinous, sensitive end of the labrum. It is in *Panorpa* a palatal fold or outgrowth, and in *Boreus* it is directly continuous with the labrum. For convenience, therefore, we will call this soft, non-chitinous, whitish highly sensitive fold projecting beyond the labrum the parepipharynx. And here it may be said that a very close relationship appears to exist between the parepipharynx of *panorpidae* and of the microlepidoptera, especially the *tineidae*, and in this point the *panorpidae* are quite unlike the neuroptera as restricted by Brauer and myself, which do not have a parepipharynx. In fact the parepipharynx appears to be mainly developed in the suctorial insects, such as the hymenoptera, lepidoptera and diptera, and also the mecaptera, but is not well developed in exclusively biting insects, which have the mandibles well developed.

Dr. Walter's figure and account of the labrum and epipharynx of *Micropteryx semipurpurella* is of special interest in connection with the structure of the homologous parts in *Boreus*. In the tineid in question, the five-sided or rather triangular, narrow, horny labrum is hollowed out at the end, the hollow being filled by the pale, sub-membranous parepipharynx, which projects out from under the labrum and completes the apex of the triangle made by the two organs collectively. Now the labrum-epipharynx of *Boreus* and *Panorpa*, is rather long, narrow and triangular; in *Panorpa* the labrum ends in a corneous point, and the epipharynx forms two pale, membranous flaps on each side, as seen from above; in *Boreus*, however, the labrum ends in an obtuse point, and in fact appears at first as if hollowed out, as there are two dark thickened mandible-like portions on each side of the labrum, free from setae and sensory pits. The parepipharynx forms a pale whitish, obtusely pointed projection of the end of the labrum, and is not, as in *Panorpa*, divided into lobes extending along the sides towards the base of the labrum.

I regard the structure of the labrum-epipharynx of the mecaptera, and on the other hand the interesting discovery by Walter of the primitive lepidopterous maxilla of *Micropteryx caltella* with the lacinia (the homologue of one half of the "tongue") and the galea, besides the maxillary palpus, as very strong proof of the origin of lepidoptera from mecaptera-like forms. Walter does not state how nearly the shape of the galea of the *Micropteryx* in question corresponds to that of the true neuroptera (in sensu Brauer) but it is noticeable.

To return to the sense-organs developed in the labrum-epipharynx. The sensory organs are of two kinds *i. e.*, taste-cups (Will) and taste-rods, besides tactile hairs and defensive setae, as well as what seem to be "gathering hairs" (Cheshire).

In *Panorpa debilis?* the labrum as seen from above is acutely triangular and edged with a single, slightly irregular row of long, stiff defensive setae which project a little beyond the edge of the epipharynx, both in front and on the

side. In both the male and female on each side near the base of the epipharynx, is a group of about 20-25 taste-cups, each giving rise to a short hair. There are also scattered taste-cups near a point corresponding to the end of the labrum. On the upper side of the free edge of the epipharynx, there are scattered taste-cups, varying in size, and like those already mentioned, though some of them are without perceptible hairs.

At the end of the epipharynx in the female are several gustatory pegs or rods; but in the male examined they seemed to be more numerous, there being a group of two short stout ones in the middle, one on each side of the median line of the body; and a group of four larger ones on each side of the central pair.

On the under side of the epipharynx there is a striking variety of hairs, differing much in character and variously grouped. Around the edge of the anterior division of the organ, there is a single row of very long, rather stout setae, apparently tactile, possibly both tactile and defensive. The edge, however, of the basal division of the epipharynx, is thickly fringed with long slender hair-like setae, flattened and triangular at the base. Three of the setae are larger than the others and spinulose. The greater part of the organ is free from hairs, there being only two groups near the middle of fine slender hairs which are flattened and broad at the base; these, like those fringing the edge of the basal division, in shape resemble the "gathering" hairs of the bee's proboscis, and are evidently for the purpose of collecting and amassing moisture, whether the saliva or the liquids entering the mouth, or both, we cannot say. These delicate gathering hairs, *i. e.*, those which are very slender and flexible and arising from a flattened triangular base, as we have seen in *Vespa maculata* and *Nematus erichsonii*, line the pharynx, above and beneath, though of varying sizes and mode of grouping. Indeed, the epipharynx is simply a continuation and outgrowth of the roof of the mouth. The exact function of these hairs remains to be determined. They seem to be, so to speak, colossal chitinous cilia, serving at times to retain the saliva or liquid food in certain places, and in others to facilitate the passage of the food down the throat.

The labrum-epipharynx of *Boreus californicus* is quite different in shape from that of *Panorpa*; it is a little longer than broad, not dorsally separated by a distinct transverse suture from the clypeus, though laterally separated by a distinct notch. The labrum itself is not longer than broad, and not excavated in front, but on the contrary somewhat produced, extending into the base of the parepipharynx. Near the base at each side is a dark chitinous triangular thickening of the shape of a mandible, but not dentate at the end. Between the base of these mandible-like thickenings is a group of four taste-cups, protected on the inside by three defensive setae. On each side of the median line of the labrum, and extending back under what

appears to be the end of the clypeus are two narrow thickenings of the surface, along which are scattered taste-cups, there being about 20 on each side of the median line.[6] There is also a taste-cup on an area corresponding to the thin, front edge of the labrum, about midway between the most distal taste-cup, and the tip of the mandible-like thickening.

While the epipharynx of *Panorpa* scarcely projects beyond the acute end of the labrum, and is apparently divided into two large lateral divisions, and moreover is divided into a basal and distal portion (a somewhat significant fact in connection with the possibility that the labrum represents a pair of appendages); in *Boreus* the parepipharynx extends well beyond the end of the labrum, and shows no signs of a division into lateral or longitudinal lobes. It is a somewhat crescent-shaped whitish fold, tending in front of the labrum to a distance nearly half its width. There are no taste-cups on it, but around the edge a series of about 16 large taste-rods, which project as far as the marginal hairs situated between them. They are considerably, about twice, as long as those at the extremity of the epipharynx of *Panorpa*.

All of the hairs appear to be of the kind denominated gathering hairs, and we do not appear to have the marked differentiation into different kinds of hairs and setae noticeable in the epipharynx of *Panorpa*. They are in *Boreus* arranged in about six curvilinear series; and are broad at the base, not triangular, but with parallel sides until in the middle they suddenly contract into hairs. They are probably neither specially tactile or protective, but rather adapted for gathering liquids and promoting their flow down the throat.

*Taste-cups on the labium and maxillae of Panorpa.*—In the same species (*P. debilis?*) I have noticed taste-cups on the labium in two regions; a group of five or six on the upper surface, on each side at the base of the first or basal joints, also a group of about a dozen on each side of a region including the base of the labium and end of the mentum. These taste-cups are characterized by having a short minute hair arising from the centre of the cup. They were observed in the male, but undoubtedly occur in the other sex, as I have not as yet observed any sexual distinctions in this group as regards the distribution either of gustatory or olfactory organs.

In the maxillae of the same species there are in both sexes a few taste-cups, protected by long defensive setae on the stipes near the base of the palpi; and in the male I noticed a group of five such pits at the base of the lacinia, while others are scattered along the outer edge, near the base of the singular series of marginal comb-like sets of flattened,

6 It should be observed in view of the figures by Dr. W. Patten, Studies on the eyes of arthropods, Journ. morphology, July, 1888, v. 2, pl. 7, p. 1–7, of the labrum of *Acilius*, which appears to answer to a pair of limbs representing a first pair of antennae; that in *Boreus*, besides the bilateral mandible-like thickenings the labrum also appears to be slightly divided along the middle by these two parallel ridges or thickenings, giving rise to the appearance of an obsolete median suture. But this needs further examination.

curved, scraping hairs. A few taste-cups were also noticed scattered in a row along the outer edge of the galea of the female.

*Taste-cups on the maxillae of Boreus californicus.*—No taste-cups were observed on the labium of *Boreus*, which is very different in shape from that of *Panorpa*, unless four or five pits protected by two or three spines and situated at the base of the palpi are such. On the basal region of the galea of the maxillae, however, there is a series of taste-pits, the basal one the largest. No hair arises from the centre, and the pits are protected in front and on the outside by unusually short and stout peg-like defensive setae.

The structure of both the labium and maxillae of the mecaptera is very interesting, but space forbids our entering into farther details.

*Olfactory rods on the palpi of Panorpa and Boreus.*—At the end of the second or distal joint of the labial palpi of *Panorpa* is the usual pale area, bearing about 18 small short rods, which are probably olfactory; these are as usual roughly arranged in two series, and by groups. The last joint of the maxillary palpi bears olfactory rods of the size and number of those in the labial palpi. The end of the distal joint of the very short labial palpi of *Boreus*, is provided with about ten small olfactory rods which are slightly larger than those of the maxillary palpi.

The rather acute end of the maxillary palpi terminates in a pale clear space through which can be dimly seen the nerves leading to the seven or eight olfactory rods, which themselves are a little smaller than those of the labial palpi. Also at the distal end of the second joint are four sensory pits.

*The olfactory pits of the antennae of Panorpa and Boreus.*—In the terminal antennal joint of the female of *Panorpa* there are to be seen on one side about 35 olfactory pits scattered irregularly among the setae. In both sexes of *Boreus*, there are to be seen on one side of the last joint about eight olfactory pits, none at the end; on the penultimate joint there are on one side five pits, three in a row on one side, two on the other; the third and fourth joints from the end have two on the side next to the observer, the fifth and sixth one each.

Of course the exact function of these antennal pits is hypothetical until determined by repeated experiment; but provisionally they may be regarded as olfactory in their nature.

In conclusion we may say that by the use of the creosote and oil of turpentine mixture, the sense-organs can be easily examined superficially, and it is very fascinating work. It should, however, when possible, be supplemented by the preparation and examination of sections, after the most rigorous and exact histological methods, so as to reveal the nerves and ganglion cells of special sense.

The specimens of *Boreus* were kindly given me by Dr. A. Agassiz, Director of the Museum of Comparative Zoology, Cambridge, Mass.

# OBSERVATIONS ON SOME VARIATIONS OF THE MALES IN CLINIDIUM.

BY FREDERICK BLANCHARD, LOWELL, MASS.

In the Transactions of the American Ent. Soc. v. p. 162, Dr. LeConte discusses at some length the *Rhysodidæ* of the United States. A recent examination of a small series of *Clinidium* showed, on comparison with the notes and descriptions in the above mentioned paper, quite considerable differences in the ♂ characters. There are before me four males and nine females. Of these, only one, a ♀ without locality, has the thorax oblong as required by the definition of *sculptile* given by LeConte. The others have the thorax distinctly narrower anteriorly as is said of *calcaratum*. One ♂ from D. C. agrees in its sexual characters with the description of *sculptile*; the anterior tibiæ, however, are much more strongly angulate than is indicated by the figure given. For the sake of comparison the following copy is given of the description of the ♂ of *sculptile*; — "Front thighs distinctly toothed; front tibiæ rather suddenly dilated on the inner side, above the oblique groove, then sinuate; middle and hind tibiæ subsinuate on the inner side, produced inwards at tip into a sharp process. Prosternum with a broad stripe of velvety surface; ventral segments with spots of similar pubescence."

In *calcaratum* ♂, the 'Front thighs are not toothed; front tibiæ very feebly dilated on the inner side; middle and hind tibiæ with a large pointed apical process on the inner side, one half the length of the tibiæ; under surface without velvety spots.

A second ♂ from N. C. is like the first mentioned, but differs in having the hind thighs distinctly toothed inside, just before the apex, and in the prosternum being quite smooth at the middle, without any trace of velvety pubescence. The hind tibiæ are more distinctly sinuate.

In two other males also from N. C., the front thighs have a small tooth; the front tibiæ are rather suddenly narrowed at base and not at all angulate; the middle and hind tibiæ with apical inflexed process, on the posterior ones very strong, apparently quite as well developed as is said of *calcaratum*; hind thighs as usual, merely sinuate before the apex; prosternum smooth, abdomen with velvety pubescence on the first four segments.

A majority of the females seen have the last ventral strongly protuberant at middle, and transversely impressed behind. Others are intermediate between these and those having the same segment merely feebly convex. In all, the front thighs are not toothed, the middle and hind tibiæ simple and the prosternum and abdomen without velvety spots at middle.

To exhibit it a glance the differences in the males the following table is added:

Anterior ventral segments pubescent at middle, front thighs toothed.

Front tibiæ angulate.

Hind thighs not toothed, prosternum velvety pubescent at middle.

A. *sculptile.*

Hind thighs toothed, prosternum smooth. B.

Front tibiæ sinuate, not at all angulate, prosternum smooth, hind tibiæ with stronger apical process.

C.

Ventral surface without velvety pubescence along the middle, front thighs not toothed, front tibiæ not angulate, apical processes of middle and hind tibiæ very long.

D. *calcaratum.*

*C. sculptile* Newm. is not rare in the Atlantic States. *C calcaratum* Lec is from Or. and V.I.

Were the above described secondary ♂ characters in A, B, and C, accompanied by any constant differences in form or sculpture, three very distinct species would seem to be indicated; but there does not appear to be the slightest clew to show which females belong with any of the males, and it is perhaps not impossible that a series of specimens may prove that the ♀ of D, is not easily distinguishable from the eastern forms.

In conclusion it is suggested that those who are located within the faunal limits of *Clinidium* examine their material for the purpose of learning if all the variations mentioned, or any others not yet noted, occur in one locality. In the vicinity of Lowell the family does not appear to be represented.

## SOME NEW COMPARISONS OF PIERIS OLERACEA WITH P. NAPI.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

As *Pieris oleracea* of North America has been regarded as identical with *P. napi* of Europe by some who have studied only the markings of the wings, I have thought a comparison based on the early stages would be desirable; this I am now able to make by the kindness of Mr. J. Jenner Weir of England, who has kindly sent me a number of specimens of blown larvae and living chrysalids of the latter. Other caterpillars from the continent have been ofservice.

The mature caterpillar of *P. oleracea* differs from that of *P. napi* of Europe in the more uniform pile with which the body is clothed, and by the apparent absence of those comparatively large conical wartlets, ten or twelve times larger than the smaller ones, which form so conspicuous a feature in both *P. napi*

and *P. rapae*, and which are arranged at subequidistant intervals in a transverse row on each of the subsegments of the body; they are present in *P. oleracea*, but are not nearly so large relatively as in *P. napi*, except possibly on the stigmatal subsections of the anterior part of the body, and are further inconspicuous in being either concolorous with the body, or white, or only a little infuscated, while in both the other species mentioned they are piceous and most conspicuous; occasionally, however, when white, they are marked with a fuscous annulus around the base and so are made more conspicuous, but herein they approach the normal type of *P. rapae* and not of *P. napi*.

The chrysalis of *P. oleracea* differs from that of *P. napi* of Europe, first, in the following structural features: the frontal tubercle curves distinctly upward, while that of *P. napi* is directed straight forward; the elevation of the suprastigmatal carina to a distinct, spinous, compressed tubercle on the sides of the anterior part of the third abdominal segment, is far more marked, and the tubercle itself distinctly flares laterally, which that of *P. napi* cannot be said to do. Second, in colorational peculiarities: Chrysalids of *P. napi* are far more heavily marked; especially the suprastigmatal carina is margined interiorly with large blackish uscous patches forming a more or less interrupted band over the second to the eighth abdominal segments; the fourth of the tenth segments have a distinct mediodorsal black dash at the anterior margin; and the disk of the wing cases is marked with a double black dash besides the black specks; none of these markings are present in *P. oleracea* except the first named, on the second and third segments, and occasionally a fuscous indication posterior to that; the black specks or dots are found on the wing cases, but the black dashes are wanting. The further dorsal markings of the abdomen of *P. napi* consist, on most of the segments, of a curving or diverging series of black dots, three on a side next the middle line above, open posteriorly, and an oblique arrangement of two black dots on either side, nearer the suprastigmatal than the mediodorsal carina, the anterior marginal or submarginal and the outer, the other anterocentral and the inner; none of these except the submarginal dot of the outer series is found at all in *P. oleracea*, and then only, as a general rule, on the third to the sixth segments and accompanied on the fifth and sixth by a companion dot, sometimes double, a little way above the spiracle.

The male imago of *P. oleracea* differs structurally from that of *P. napi* in the hook of the upper organ of the abdominal appendages, which is shorter and more strongly curved at tip, while the semicorneous expansion of the under edges of the base is not a downward directed, vertical lamina, thickening into a posterior, downward directed thorn, but a short curved hook, opposed to the hook of the upper organ.

# PSYCHE.

CAMBRIDGE, MASS., FEB.-MAR. 1889.

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## LAC INSECTS.

Mr. B. P. Mann sent me 24 July 1885. two specimens with lac insects from Lavedo, Sonora, collected by Dr. E. Palmer. about 60 miles from Fort Yuma on the Colorado River. One is *Carteria mexicana*, Comstock, Report U. S. Dept. agric. 1881 p. 212; Cornell univ. Exper. stat. 1883, 2d rept. p. 130 no. 125, from the twigs of *Larrea mexicana*. The other from *Pluchea borealis* has much larger lac lumps and seems to be new. Both insects puncture the older stems and the lac is secreted upon them. This gum occurs in great abundance and is used by the Indians to mend their baskets and pots and to fasten the handles into them. Moreover the Indians in their games and walks have foot-balls which they make by coating stones with this lac and kick-along before them.

*H. A. Hagen.*

## MIGRATION OF *AGANISTHOS ACHERONTA*.

Mr. S: H. Scudder having asked me for the details of an observation to which reference is made in the *American naturalist*, April, 1877, v. 11, p. 245, I have turned to my notes made in Brazil, in 1871, and found the following entry:—

"Fr. Feb. 17. . . . Great numbers of No. 1503 followed each other singly at intervals across the meadow in front of the house, migrating apparently, and were very difficult to catch."

Mr. H. K. Morrison states that my No. 1503 is *Aganisthos acheronta* Fabr. I believe the determination was made for Mr. Morrison by Mr. Herman Strecker.

I remember the occasion of the observation. The butterflies came with powerful rapid, direct flight, perhaps from three to five meters above the level of the meadow, from the direction of a rising ground or small hill near by. After seeing several and noticing the uniformity of their behavior, I ascended the hill, and thus, so far as I recollect, came within reach of them. From how great a distance they came I could not tell, nor can I now say from or to what direction of the compass they flew. The season, as will be noticed, was early fall

*B: Pickman Mann.*

## DURATION OF LIFE IN AN EPHEMERA.

What is probably *Ephemera* (*Leptophlebia*) *cupida*, is common at Providence, R. I., on the banks of the Seekonk about the middle of May. Of four specimens carefully taken, some of them at different times, with a net and allowed to fly into a bottle, and then transferred to a tumbler, one lived about twelve hours, and another 24 and a third 48 hours. A fourth individual was captured Saturday P. M., at five o'clock. It was in the subimago stage, being of a dull slate-gray with none of the reddish hues of the imago. It lived about a day before moulting, when the colors appeared, *i. e.*, flesh tints at the base and on the costa of the fore wings, as well as on the pterostigma. It had moulted Monday and lived a full week after, being observed alive the following Monday morning, but was found dead in the tumbler Monday morning, May. 14, 1888. It had thus lived over eight days, without taking food. Had

it mated soon after casting its subimago pellicle it is probable that it would not have lived but a day or two longer. *A. S. Packard.*

## PAIRING OF XYSTICUS TRIGUTTATUS.

The engraving shows the pairing of one of our most common crab spiders, *Xysticus triguttatus* Keyserling. The spiders were seen on the 5th of June, among the short

grass in an open pasture between Salem and Swampscott, Mass. The female held herself, head downward, on a blade of grass with the abdomen turned away only enough for the male to reach under it with his palpi. There did not appear to be any web on the grass, though there may have been a few threads for the female to hold by. *J. H. Emerton.*

## TROX AT ELECTRIC LIGHT.

The fondness of various species of *Trox* for electric light has increased considerably the list of species known to inhabit Illinois. The following list includes all known to me.

1. *Trox scabrosus* Beauv. Taken at electric light at Springfield 20 June 1885, by Mr. C. A. Hart.

2. *Trox monachus* Hbst. There is a specimen of this species in the collection of the State entomologist from Union Co. It has also been taken near Pittsfield Ill.

3. *Trox asper* Lec. One specimen obtained at electric light at Springfield.

4. *Trox punctatus* Germ. Not uncommon throughout the state.

5. *Trox tuberculatus* Deg. Specimens in the State entomologist's collection taken at Centralia 22 April.

6. *Trox erinaceus* Lec. Rather rare but found throughout the state.

7. *Trox capillaris* Say. Specimens in the State entomologist's collection from La Salle Co.

8. *Trox unistriatus* Beauv. Quite common throughout the State.

9. *Trox foveicollis* Har. Rather rare.

10. *Trox terrestris* Say. I have seen specimens from Pittsfield.

11. *Trox aequalis* Say. Rare in northern and central Illinois.

12. *Trox scaber* Linn. Taken at Galesburg.

13. *Trox atrox* Lec. Recorded by Horn from Illinois.

Only eight other species are known in the United States.

*C. W. Woodworth.*

LUMINOUS EGGS OF INSECTS.—E. Mulsant observed and recorded in 1862 the fact that the eggs of *Lampyris* were luminous. This observation was confirmed by Dr. A. Laboulbène, who published the statement in 1882, but some entomologists have doubted the fact of their luminosity. Wielowiejsky, who published a paper in 1882, that dealt thor-

oughly with the luminosity of *lampyridae*, says the eggs can be luminous only on account of some external substance which they derived from their mother, or on account of light-giving power of the young larvae within them. Again, Laboulbène and H. Lucas have published (Bull. entom. Soc. entom. de France, 12 Sept. 1888, p. 133-134) the fact that the eggs of *Lampyris noctiluca*, as well as its larva, are luminous, and Laboulbène states that the luminosity lasted about a week.

*G: Dimmock.*

PHOSPHORESCENCE OF MYRIOPODS.—M. J. Gazagnaire has lately studied the phosphorescence of *Orya barbarica*, an Algerian species of *geophilidae*, and finds that it is caused by a viscid secretion from the pores on the ventral side of the whole length of the body. This is contrary to the view of Dr. R. Dubois, who supposed the phosphorescence to have its origin in the epithelial cells of the digestive tract. M. Gazagnaire has further found that the phosphorescence does not occur at all times, but that its appearance is during the time that the genital organs of the *geophilidae* are in a state of activity.

*G: Dimmock.*

THE MECONIUM OF BUTTERFLIES: — M. Théodore Goossens communicated a notice to the Société entomologique de France, 11 April 1888, on the above subject. We translate the notice in full from the *Bulletin entomologique* of that Society.

"If the rearing of larvae affords gratification in studying, as far as possible, their habits, it sometimes gives one bitter disappointments. Sometimes all the caterpillars, almost full-grown, die at once without a trace of diarrhoea or of fungi, that is to say of other causes than flâcherie or muscardine. After having sought in vain the cause of the trouble, one forgets it until a similar accident happens."

"Chance taught me one of the unknown causes of this mortality. For several years I have reared different caterpillars in colored boxes for the purpose of determining the influences of refrangibility upon lepidoptera. The blue being, among the simple colors, the one that favored best their development, I had placed some pupae of *Vanessa prorsa* in a blue box. There were already in this box some half grown caterpillars of *Fidonia atomaria*, but they were in a tube and the tube had a cork stopper. A *Vanessa prorsa* emerged, expanded itself, and, ready to take to flight, discharged the meconium which it had accumulated during the pupal state. This meconium fell upon the stopper of the tube and immediately the twenty caterpillars were dead. It was difficult to ascribe such a power to the meconium. A second *Vanessa* again furnishing this liquid, I took some of it on a brush, and put it in another box where there were some caterpillars of no value to me. In a short time they likewise died: but other caterpillars touched with dry meconium lived as usual.

"It seems then, that it is the vapor of this substance, composed mostly of uric acid, that has the property of killing caterpillars, and that when we rear caterpillars in the same vessel in which chrysalids are already formed, we subject ourselves to the same accident without suspecting the true cause."

*G: Dimmock.*

HOUSEHOLD PESTS.—The editor of *Good housekeeping* received a considerable number of letters in competition for the prizes mentioned on p. 59, of this volume of *Psyche*, and the decision as to the merits of the various remedies proposed was left to Dr. C: V. Riley. The numero of *Good housekeeping* for 27 Oct. 1888, gives Dr. Riley's letter in reference to the remedies proposed, and quotes not only the letters of the prize-winners, but all those mentioned by Dr. Riley as meritorious. This collection of letters is an excellent symposium on remedies for household insects. *G: Dimmock.*

# MYRMECOPHILISM.

BY WILLIAM TRELEASE, ST. LOUIS, MO.

[Address of the retiring president of the Cambridge Entomological Club, 11 January 1889.]

It is customary in some circles for a president's address to consist of a general résumé in some line of scientific work. I have availed myself of this opportunity to review the more important literature on a branch of biological work which has long possessed an unusual degree of interest for me,—namely, the mutual relations, amounting in some cases to symbiosis, existing between ants and certain members of the vegetable kingdom. Such a forced review is profitable to the writer, and it may be of interest to the body before which it is read; but it by no means follows that it has scientific value, for each worker must perforce go back to original sources for information needed in his own researches. Quite naturally, I have treated the subject from a botanical standpoint, since, with the exception of certain acquired habits, the specializations are chiefly such as fit plants to profit by the visits of ants to their vegetative or fruiting organs.

## 1. The functions of extra-nuptial nectar-glands.

The chief sorts of glands situated on the surface of plants or opening superficially, are divided into colleters and nectar-glands, according as they secrete resinous, mucilaginous, or gummy substances in the one case, or sugary fluids in the other. The first are apparently for the most part protective, in that they form a coating over young parts in the bud, which prevents drying or other injury; or they prevent the access of unbidden guests to the flowers or fruit, or deter vegetable feeders from making an onslaught on the parts which bear them,—in this respect resembling raphides, alkaloids, volatile oils, etc., within the plant.* A few such structures serve for the attachment of fruit or seed to animals for purposes of dissemination, etc. The digestive glands of carnivorous plants may, perhaps, be regarded as derived from some of the numerous types of colleters, and the foliar nectar-glands of many plants are pretty clearly homologous with the serration- and other colleters of the same and related species. Typical colleters are, therefore, chiefly protective, and there is good reason for believing that many of them have been evolved for preventing the access of ants to the flowers of plants, where, almost without exception, the presence of these insects works mischief.

Nectar-glands, on the other hand, are of indirect use by attracting suitable pol-

* For a recent discussion of the protection of plants, especially from the attacks of snails, by colleters and other deterrent structures, see an elaborate paper by Stahl in Jenaische Zeitschrift für naturwiss. und medicin, xxii.—reprinted under the title "Pflanzen und schnecken," Jena, 1888.—Abst. in Bot. centralblatt, 1888, v. 36, p. 164-170.

linators to the flowers, by luring prey to the digestive apparatus of some carnivorous plants, or by maintaining upon the plant a body-guard of pugnacious insects, which more or less efficiently protect it against certain of its enemies.

Since the time of Sprengel (29), it has been well known that many flowers contain glands which secrete nectar as a source of attraction to insects able to cross-pollinate them. The occurrence of this fluid was known long before his day, but its use was either not investigated, or misunderstood. Indeed his keen insight into its *raison d'être* was scarcely appreciated for three-quarters of a century, until Mr. Darwin took the subject in hand in his classical work on the pollination of orchids. To-day, however, Sprengel's views, cleared and somewhat broadened, and carried into a thousand little details that he had not followed out, are contested by very few persons. So far as our purpose is concerned, nothing further need be said of floral nectar, since the structure and habits of ants are such as to practically debar them from any important rôle in pollination. In fact entomophilous plants usually teem with devices for preventing their access to floral nectar,—for which, very naturally, they have a great liking.

The relation of extra-floral nectar to the fructification of plants was, I believe, first clearly pointed out by Delpino, (6, 86), who coined the terms "nuptial" and "extra-nuptial" to indicate on the one hand that which attracts pollinators, and on the other, that which is of no value in this respect. These terms are much less objectionable than "asexual" and "sexual," the former of which has recently been used by Kny (13) as synonymous with extra-nuptial. With nuptial nectar secreted outside the flower, we have quite as little to do as with that secreted within it, for the reasons already indicated; but the subject of extra-nuptial nectar and its relation to ants, is deserving of a much fuller discussion than can be given to it here without going into details to a tiresome length.

Without an undue amount of searching, I cannot say when or by whom it was first observed that certain flowers produce nectar outside of their flowers, but it has certainly been known for a long time. Hall, a pupil of Linnaeus, had seen the extra-floral glands of various plants (11, 266). Krünitz (14), whose work I know only from references in Sprengel and elsewhere, observed bees at the stipular nectaries of *Vicia*, over a century ago, and similar observations had undoubtedly been made, if not heeded, even earlier. But the first careful investigations into organs of this sort, and their secretions and uses, were made simultaneously but independently by Delpino (6 and 7) in Italy, and Belt (2), in tropical America. While other observers have contributed many isolated facts to the knowledge of these organs in the fifteen years since the observations and conclusions of these naturalists were published, the task of following up and systematizing the distribution of protective nectar has de-

volved upon Delpino (8), whose evidently thorough studies are now in course of publication, the results already printed occupying over 150 quarto pages.

Broadly speaking, this class of extra-floral nectar-glands, by their secretion, attracts to the plants which bear them hordes of ants (rarely wasps), which constitute a temporary and changing body guard, disputing the presence of all other insects with the exception of their protégés the sugar-excreting aphides, coccids, etc., and resisting, often furiously and effectively, the onslaughts of ruminants and other large animals. That this is a true explanation of the reason for the existence of these structures, is generally admitted, today.*

The plants which possess such glands are phaenogams and ferns, chiefly of the tropics and subtropics; yet the number in our own and other temperate floras is rather surprisingly large.

The ants attracted by extra-nuptial nectar are mainly the omnipresent, omnivorous species. Protection is often afforded against various caterpillars and other leaf-eating larvae, as Ratzeburg (24) and others have observed; but the body-guard appears primarily destined to resist the depredations of other members of their own group,—the leaf-cutting ants,—which swarm in tropical and subtropical regions, and quickly defoliate plants not provided with this defence unless efficient service is rendered by colleters or alkaloids, which prevent the access of these insects to immature and tender parts, or render these distasteful to them. Delpino was at first inclined to explain the occurrence of protective nectar in regions where no leaf-cutting ants are found, solely with reference to herbivorous larvae. But it has been shown several times that such larvae are permitted in large numbers on plants provided with a body-guard of ants attracted by nectar. I have myself observed this in the case of *Gossypium*, which suffers notoriously from the attacks of *Aletia* and *Heliothis*, although it is unusually well supplied with extra-nuptial nectar that attracts numerous ants which to a certain but insufficient extent do attack the caterpillars of the moths named. The same thing is also to be seen on *Populus monilifera* in the west and south, where this tree is subject to very disastrous attacks from the larvae of a chrysomelid beetle, *Plagiodera scripta*, and a moth, *Acronycta populi*. Careful observations of the behavior of insects attracted by extra-nuptial glands, carried through a number of seasons, and on plants with differing surroundings, accompanied by correct identification of the insects are possible to local entomologists everywhere, and are much to be desired.

There seems little reason to doubt

* For a general negation of the prevalent notions concerning nectaries of all sorts, coupled with a good histological study of many of these organs, reference should be made to Bonnier's essay—Les Nectaires—in Annales des sci. nat., Bot., 1879, v. 8. also published separately at Paris,—which reverts to the theories of the last century.

It is also to be observed that Kerner von Marilaun, the learned Viennese biologist, quite recently describes the petiolar glands of *Populus* as organs of absorption Pflanzenleben, v.1. 215),— but without giving reasons for his belief nor an indication that another function had been previously ascribed to them.

that these protective adaptations are the result of natural selection, acting through the ages of co-existence of plants and their enemies. I have long felt a conviction that the occurrence of extra-nuptial nectar-glands on so many of our own plants which are not menaced by leaf-cutting ants (except in the extreme southwest), must date back to later geological periods, characterized by a warmer climate in northern latitudes, and by a much greater prevalence of ants of many kinds than is the case with us now* ; and that a corresponding prevalence of leaf-cutting or other noxious ants is demonstrable in these periods. Unfortunately, I have never been able to pursue the subject in this direction, but the immense collection of fossil ants in the possession of Mr. Scudder must furnish instructive data for testing this opinion, when its treasures shall have been sufficiently studied to show the affinities of the prevalent genera of those times in northern America. That structures corresponding in position to the foliar glands of existent species of *Populus* were found on tertiary plants, is shown by their occurrence on *P. glandulifera*, Heer (31, p. 290), but I do not now remember that they have been recognized elsewhere.

While, as has been shown, the secretion of food for protective ants is often rendered superfluous by the provision of other more direct deterrents, the two classes of protective adaptation sometimes occur conjointly. Lundström (16, p. 83) has shown that the leaves of *Populus* which do not possess nectar-glands are distinguished also by the thinness and flexibility of their compressed petioles, by which caterpillars, etc. are to some extent rendered uncertain in their footholds on these easily shaken leaves. Delpino and Schimper have also observed the protection secured to *Ricinus* by its smooth and very glaucous stems, though its leaves likewise bear extra-nuptial glands.

An aberrant function of the nectar-glands on the leaves of some pitcher plants is that of luring to their destruction, insects which are captured and digested or at least macerated by these carnivorous plants. From the large number of ants found in our *Sarracenia* leaves in a state of nature, this would seem to be true of species of this group; for these ubiquitous insects are certainly led to the orifices of the pitchers by the sugary secretion on the exterior. In his latest paper (8, 227), Delpino holds this secretion to be protective, as in the cases already passed in review; but the opinion which I have here and elsewhere (30, 328) expressed, is that of Riley (25, p. 25), Mellichamp (18, 119), Gray (10, 112), and others, some of them early writers on *Sarraceniaceae*. That ants are largely victimized by these plants does not, of course, signify that the structure of the latter is not such as to facilitate the capture of larger, flying insects, which are, in fact, often found entrapped, especially by the southern Sarracenias and the Californian *Darlingtonia*.

* On this point see a very instructive note by Mr. Belt in Nature, 1877, v. 16, 122.

Leave cannot be taken of the extra-nuptial nectar of phaenogams and ferns without reference to the sugary exudation which escapes on the emission of spermatia of *Uredineae*. As was shown by Ráthay (23), this is greedily devoured by ants and other honey-loving insects. But the service that these render, if any is rendered, is not clear, since it is not certain whether the spermatia are spores or male reproductive cells, though there is reason for considering them to be spores.* That ants play a considerable part in scattering these bodies is a necessary *a priori* conclusion; but it is not so evident how far the secretion of a sugary fluid is to be regarded as an adaptation to this end. It has recently been explained by Ludwig (15) in accordance with the Delpino-Belt theory.

## 2. Occasional Ant-domiciles on Plants.

Some part of a plant is not infrequently tenanted by ants which find there shelter or food to their liking, but so far as our own and other temperate floras are concerned, there appears to be no adaptation by which the plant is fitted to maintain or especially profit by this residence of ants. The heart-wood of some of our forest trees is often inhabited in this manner by the large black ant, *Formica pennsylvanica*. On several occasions I have also found an undetermined small brown ant nesting in the old hypanthia of *Calycanthus*, still adhering to the plant, in the botanic garden at St. Louis. No doubt any close observer of the ways of ants can add many instances of the same general character, in which, so far as the biology of the plant is concerned, the ants are merely accidental residents, though their pugnacity may lead them to resist the attacks of other creatures whose presence is distasteful to them.

It is also known that ants sometimes construct somewhat elaborate nests on plants. Some cases of this sort are noted by Westwood (34, 222) and Packard (21, 317), and I presume that a person more familiar than myself with entomological literature could cite other references on this subject. Several years ago I contributed to the Club the gist of observations on a colony of *Crematogaster* which had erected a nest over their wards, certain aphides, on a branch of *Andromeda*, where they apparently spent their entire time (Psyche, v. 3, 31). Similar nests had been observed before by others (Psyche, v. 3, 343; and the Minutes of the meetings held during 1883, 2). In the case observed by myself the ants appeared to be kept at their post by the aphides (which they may themselves have placed upon the plant), and the shelter was evidently constructed as much for these insects as for themselves. Where ants protect the enemies of a plant in this manner, they are clearly injurious to it in the first place, though they may at the same time keep off others of its enemies in endeavoring to guard their protégés. The good may even more than counterbalance the harm done, and Lundström has suggested that in

* See Plowright, managr. of British Uredineae and Ustilagineae, 1889, 11 *et seq.*

some cases aphides may be held as serving their host-plants in the capacity of wandering nectaries (16, 84). It is certain that they are sometimes a stronger source of attraction to ants than either nuptial or extra-nuptial glands.

### 3. Myrmecophilous Plants, proper.

Some of the earlier travellers, in describing their collections, make mention of the fact that cavities in the stems and stipules, or pockets on the leaves, of some tropical plants are tenanted by ants. This was recorded for *Cecropia* as early as 1648 by Marcgravius (17), and for *Acacia* in 1651, by Hernandez (12). Though scattering observations of more or less biological interest occur in the literature of the succeeding 225 years, it was not until the early part of the last decade that these plants received careful study. In 1872 Professor Caruel published a short paper (3) on species of *Hydnophytum* and *Myrmecodia*, two rubiaceous genera that had been known to harbor ants at least since the studies of Rumpf in 1750. The field notes and material for this paper were obtained from Beccari, who was led to believe that shortly after germination the bases of these plants are pierced by ants (subsequently identified as species of *Crematogaster* and *Iridomyrmex*) which tunnel the gall-like enlargement in various directions, making a permanent residence there. The plants were even thought to die while quite small if not pierced, though these attacks might have appeared necessarily injurious, to another observer. Later observations by Forbes (9) and especially by Treub (33) who has made good use of the unusual facilities afforded by the botanical garden at Buitenzorg in Java for cultivating tropical plants, seem to show that this puncturing of the stem is not so essential to the life of the plant as was supposed by Beccari; for in a series of cultures it was found that not only do young plants and seedlings develop when removed from all possibility of ant visits, but the excavations and perforations in their stems appear spontaneously. According to Treub, these elaborate structures, which in a state of nature appear to constantly serve as domiciles for ants, represent in reality a highly developed water-tissue, by which the plant is adapted to its epiphytic habit. The view that they are not primarily connected with the maintainance of a body-guard of ants, is accepted by Schumann (28, 419) in the last extensive study of myrmecophilous plants that I have seen, so that what have for years passed for ant-plants *par excellence*, seem likely to lose even a subordinate position in the growing category of plants of this class. Yet, as it seems to me, granting the full accuracy of Treub's observations, it by no means follows that the curious structure of *Myrmecodia* and related rubiaceous plants is not to be looked upon as an adaptation for providing a body-guard of ants with lodging; and it has been abundantly proved that they are ready to fight whenever they are disturbed in these residences.

At about the time when Beccari was making his first observations on these Malayan plants, Belt (2) was engaged in a similar study of the bull's-horn *Acacia* in tropical America, and here, as in the case of extra-nuptial nectar, the credit of having first recognized the protective signification of the structure, is shared by Belt and Delpino (6, 91). As a result of his studies and those of Francis Darwin (5) and Schimper (27), it seems to be definitely settled that in the spongy enlarged stipular thorns of several species of *Acacia*, certain ants find shelter, and are kept upon the plant by a sugary secretion similar to that which attracts wandering ants to so many other species of this and other genera, while in highly nutritious bodies at the tips of the leaflets is to be seen a further food-supply,—the three provisions securing their permanent residence.

*Cecropia peltata* and some other species of the genus are also known, thanks to Fritz Mueller (19), Francis Darwin (5), Schimper (27), and others, to produce upon their petioles food-bodies that are likewise eagerly gathered and eaten by ants, which inhabit the hollow stems of these species. Quite recently Schimper(27) has shown that in *C. adenopus* an unmistakable provision facilitating the entrance of the ants, exists in a thin soft spot observable on each internode of the hollow stem,—a fact which was indicated in 1876 for the Imbauba, by Fritz Mueller (4).

The number of species that may be classed as truly myrmecophilous, in that they afford lodging, sometimes accompanied by a provision of nectar or solid food, or both, calculated to maintain upon them a permanent army of ants, is already large. All are, so far as I know, phaenogams, but they are distributed through widely separated orders in this group. To Beccari, more than to any other single naturalist, is due the credit of having systematically undertaken their study in the field; and few biologists have published their observations so sumptuously as his appear in the volumes of his "Malesia." Unlike the plants with simple extranuptial nectar, these symbiotic plants often show a restriction in the species of ants which frequent them. And it is interesting to observe that closely related species sometimes inhabit myrmecophilous plants of widely separated regions.* Time will not permit me to enter into a more detailed discussion of the many cases of proved or probable symbiotic myrmecophilism, but enough has been said to show that on the one hand myrmecophilous plants join closely to those which provide food for a body-guard of ants which they do not furnish with a residence; while on the other hand they offer equally good transitions to those more or less constantly inhabited by ants which must seek their food from other sources than special secretions or derivatives of the plant. While both of these classes are represented in temperate climates, it is suggestive that the most highly specialized cases of myrmecophilism are not known to occur out-

* Cf. Schumann, *l. c.*, p. 416.

side the tropics, where, as the observations of Belt, Fritz Mueller, and others show, plants that do not possess some special and effective means of repulsion or defence are quickly stripped of their foliage, and where, from a persistance of this danger since the cooling of higher latitudes, natural selection has been kept in operation after it ceased to work great changes in this respect elsewhere. As might be expected, myrmecophilism in the more restricted sense may be replaced by other protective devices; and Schimper (27) has in fact shown that a tropical American species of *Cecropia* is enabled to dispense with the body-guard needed by its relatives, through having very glaucous stems, over which leaf-cutting ants cannot climb to its foliage.

In 1887, a rather remarkable paper (16) was published by Lundström, of Sweden, in which the hairy nerve-axils on the lower leaf-surface of oaks and other woody plants, the pits similarly situated on the coffee plant, etc., and a variety of other structures, were described under the name of domatia (diminutive of δῶμα, a house). The greater number of these are held for mite-domiciles (acaro-domatia), but it appears as if a fairly good series might be made from the simpler acaro-domatia to some of the more specialized pockets of leaves (myrmeco-domatia) inhabited by ants, that have especially been described by Schumann (28). If this is true, a plausible explanation of the one, when reached, may throw light upon the origin of the other. It may, therefore, be worth while to note that Lundström holds acaro-domatia for slightly specialized mostly hereditary structures that serve as a shelter for various mites, which benefit the plant by clearing its leaves of fungus spores which may fall upon them, and by contributing to their nutrition carbonic acid from their own respiration, as well as their excrement, exuviae, and, ultimately, their dead bodies. While this explanation appears far-fetched to most biologists, it is not unlike that applied by Beccari to the myrmecophilism of *Myrmecodia*, the ant-inhabitants of which are thought to contribute to its nutrition in a similar manner. Whatever the value of his hypothesis may be, it must be conceded that the Swedish botanist has brought together about them a large series of little known and unexplained structures, which can scarcely be looked upon as insignificant by the present school of utilitarian biologists.

In closing, attention should be called to the relations of ants to the seeds of plants. It is well known that in warm countries some ants carefully and systematically harvest the fruit of species which are to their taste, and it would appear that they also take some agricultural interest in the welfare of these plants. While this indicates a high grade of care for the food-producing species, the benefit to the plant is that which a cultivated crop receives from the self-interest of man in its preservation and propagation, without in any way approaching symbiosis.

The resemblance of some seeds or fruits to different kinds of insects or other arthropods has several times been commented on. Perhaps it is still an open question whether or not this is mimicry, but it has been so regarded by a number of naturalists, being held in some cases to secure dissemination by insectivorous birds, etc., and in others to render the detection of the seed by graminivorous birds, difficult. Suggestions are not wanting that in some of these resemblances, and some other seminal peculiarities, adaptations exist for securing dissemination through the agency of ants. Mr. Charles Robertson tells me that the arils of *Sanguinaria* seeds possess an attraction for ants, which drag the seeds off for considerable distances. I cannot say whether they finally eat these fleshy appendages. According to Lundström (16, 79), *Melampyrum* seeds resemble ant pupae in size and form, and, as he believes, in odor also, to such an extent that ants are deceived into caring for them as if they were their own pupae, until the mistake is discovered. Mimicry, such as he suggests, is a very difficult thing to prove to the satisfaction of unbiased biologists, but observations cited by him would seem to show that unusual attention is really paid to these seeds by ants which do not subsequently make use of them for food. The bracts of some species of this genus bear extranuptial nectar-glands, which Ráthay (22 ), who studied them carefully, could not explain by the protective theories of Delpino and Belt, or Kerner, though they are visited by ants. As the latter are thus attracted close to the fruit, Lundström suggests that the office of these nectar-glands may stand in close relation with the supposed mimicry observed in the seeds, — but this entire subject, while full of suggestion, is still in need of careful and comparative study.

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# PSYCHE

A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

Vol. 5. No. 156.

April 1889.

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Published by the

CAMBRIDGE ENTOMOLOGICAL CLUB,

Cambridge, Mass., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

[Entered as second class mail matter.]

PSYCHE.

# NOTES ON CERTAIN CYNIPIDAE WITH DESCRIPTIONS OF NEW SPECIES.

BY C. P. GILLETTE, AMES, IOWA.

[Reprint, with additions, of "A study of the cynipidae" (Rept. Mich. board agric., 1888, p. 446- . Separate, 15 p.)]

I wish to acknowledge my especial obligations to Mr. H. F. Bassett and to Mr. W. H. Ashmead for the determining of many species and for the large number of typical and other specimens that they kindly sent me and which have been a great help in preparing this paper. I am also under many obligations to Dr. C. V. Riley and Mr. L. O. Howard for the determination of galls and parasites; and to Professor A. J. Cook for the opportunities and material put at my disposal in the early part of my study.

## OBSERVATIONS ON DESCRIBED SPECIES.

*Diastrophus radicum* Bass. My galls belonging to this species were received from a fruit-grower near Lansing, Michigan, in May, 1887, and a fine lot of cynips were reared from them. The galls were taken from small roots of the raspberry and appeared as irregular knotty swellings from one-half to three-fourths of an inch in diameter. These galls, which grew beneath the surface of the ground, seem to have been better protected from the attacks of parasites and guest-flies, as only true cynips were reared.

I have never heard of the galls occurring in sufficient numbers to do serious damage. In the College garden several hundred raspberry bushes were transplanted and their roots examined for the galls but none were found.

*Amphibolips coccinea* O. S. So far as I can find, this species has always been reported as producing galls on *Quercus coccinea*. The only tree on which I have taken the galls is a small scrub oak, which, I was informed by a botanist, was probably *Q. nigrum*, but, as there was no fruit on the tree, the species could not be ascertained with certainty. On this tree there were not less than thirty or forty galls, the largest of which measured one and three-fourths inches in their greatest diameter by one and one-half inches in their least diameter. These galls differ from the

galls of *A. spongifica*, for which they are often mistaken, by occurring on *Q. coccinea* and *Q. nigrum* (?) instead of *Q. rubra*, by having a thinner outer shell, by having the surface more glossy and covered with small pimples, and by having the inner radiating substance matted about the central cell, from which it can easily be removed with the fingers, instead of having these fibers grown into a hard woody center surrounding the larval cell. The fly leaves the gall about the middle of June and its general color is a reddish brown. *A. spongifica* has two dates for appearing, a portion of the flies emerging in June and the remainder in October, and the general color of this species is black.

My specimens of *A. coccinea* began appearing June 16th. Neither guest nor parasites were reared.

*Amphibolips spongifica* O. S. (*Cynips confluens* Harris, and *C. aciculata* O. S.) Walsh speaks of this species in the *American entomologist* as occurring plentifully on the black oak, *Q. nigrum*, but, although I have seen great numbers of these galls in both Michigan and Iowa on the leaves of *Q. rubra*, I have yet to find one on the leaves of *Q. nigrum*. The only flies that I have reared from these galls are those of the late part of the brood which began to appear October 3. On the 13th of October forty-seven galls were opened which gave seven true gall-flies, twenty-seven parasitised galls and the remainder blanks.

*Amphibolips sculpta* Bass. The beautiful translucent galls produced by this species I have taken on the leaves of *Q. rubra* and *Q. coccinea*. They are attached to the under side of the leaves and may well be likened to large Delaware grapes in appearance. Galls taken in Michigan began giving flies June 21. Eight of these galls taken July 5 in the vicinity of Ames, Iowa, gave only parasites, two beautiful species of *Torymus*. No guests were reared.

*Amphibolips inanis* O. S. The gall of this fly is very common on the leaves of *Quercus rubra*. Large specimens are an inch in diameter. The galls are composed of a thin outer shell connected with the central larval cell by many thread-like radiating fibers. The flies begin to appear about the 20th of June. Over 90 per cent of the galls that I have collected have contained parasites. In the majority of cases, the central cell has been found to be crowded full of the parasitic larvae of what I take to be a species of *Tetrastichus*. There is also a large species of *Torymus* that I have found common in these galls.

*Amphibolips prunus* Walsh. A single specimen of what seems to be the gall of this species was taken from the cup of a black oak (*Q. nigrum*) about the middle of August. The gall was immature and no insect was reared from it.

*Andricus clavula* Bass. The red swollen tips of the twigs of *Quercus alba*, which are the galls of the above named gall-fly, are very common in Michigan and Iowa. From these galls I have reared several specimens of the guest, *Ceroptres petiolicola*, but no true gall-flies.

*Andricus cornigera* O. S. When Baron Osten Sacken described the gall of this fly he had never seen the cynip that produced it. His specimens were taken on the pin oak, *Q. palustris*. The galls in my collection supposed to belong to this species were all taken on the red oak and may prove to be a new species. I have taken a considerable number of these galls and they all differ from a beautiful type which I have from the pin oak by being very much darker in color and more irregular and rough in outline. The galls appear like knotty swellings completely surrounding the small limbs. From all sides of the gall little seed-like bodies, much the shape and size of a small barley corn, are pushed out. These contain the larvae of the gall-fly and fall to the ground some time in July, leaving the gall full of holes. I have a single imperfect fly taken from an immature gall.

*Andricus futilis* O. S. I have searched in vain for this gall in the vicinity of Lansing, but late in the fall of 1887 I found a small *Q. alba* in Ionia county, Michigan, standing in an open field, that had galls of this species on nearly every one of its dried leaves. The flies had made their escape so that no insects were reared.

*Andricus punctatus* Bass. Galls rare, but are occasionally found on small limbs of *Q. rubra*. They vary from one half of an inch to two inches in diameter and are smooth knotty swellings surrounding the limbs much the same as the galls of *A. cornigera*. From these galls I have reared the guests, *Ceroptres petiolicola*, *Synergus lignicola* and an undetermined species; also the parasite *Decatoma varians*, but no true gall-flies.

*Andricus seminator* Harr. The brown, woolly galls, so common on the twigs of *Q. alba* in midsummer, are the product of this cynip. Galls gathered early in July gave flies the seventh of the same month. A green parasitic fly, a species of *Syntomaspis*, I have reared from these galls in fully as large numbers as the true gall-maker. No guests have been reared.

*Andricus scitulus* Bass. This species seems rare. I have taken a few of the galls on *Q. rubra* in the vicinity of Lansing, Mich., and near Ames, Iowa. In the latter case the galls were taken July 5, when the flies were found to be already escaping. A few specimens of two undetermined parasites were also reared. The galls are composed of a woody enlargement of the tips of the twigs.

*Andricus flocci* Walsh. (*Cynips lana* Fitch.) Walsh marks this species "rare." I took a number of the galls from the leaves of *Q. alba* and *Q. macrocarpa* in Michigan and find it to be one of the most common galls on both these oaks at Ames, Iowa. The galls appear as little bunches of brown wool growing out from the mid-rib, or one of the main-veins, on the under side of the leaves. Beneath the wool is a cluster of small seed-like bodies about as large as a very small kernel of wheat. Galls taken in Michigan late in the fall gave flies March 20. A few parasites, but no

guests were reared. The flies appeared in abundance.

*Andricus singularis* Bass. Galls very common on *Q. rubra* leaves. In shape and structure these galls resemble the gall of *A. inanis*, but are much smaller, large specimens seldom attaining one-half inch in diameter. The galls project on both sides of the leaves, the larger portion always being below. Galls taken June 18 gave flies June 20. No guests were reared and the galls were little parisitised. Parasites undetermined.

*Andricus petiolicola* Bass. Galls found common on *Q. alba*, *Q. macrocarpa* and *Q. bicolor*. The galls are formed by the enlargement of a portion of the petiole of the leaf, and after the leaves have fallen the galls stand out like little knotty projections. The galls that I have taken vary from 5-16 to 10-16 of an inch in diameter. Galls taken at Ames, July 3, gave flies July 5. *Ceroptres petiolicola* is a very common guest in this gall.

*Cynips dimorphus* Ash. ms. Mr. W. H. Ashmead, of the Florida Exp. Station, informs me that he has had this cynip and gall described in manuscript under the above name. Galls, red and globular, two to three mm. in diameter, and arranged in clusters of from 10 to 30 or more on the under side of the leaves of *Q. prinus*, *Q. macrocarpa* and *Q. bicolor* in September and October. Rather common. Galls taken in the fall contained larval cynips on the first of July following.

*Cynips strobilana* O. S. The gall of this cynip I find quite rare. The galls are easiest found after the leaves have fallen. They have been taken from *Q. macrocarpa* and *Q. bicolor*. The individual galls are irregular, cone-shaped bodies, from fifteen to thirty of which constitute a cluster which always arises from a terminal bud. My largest cluster measures nearly two inches in diameter. Specimens taken last October still contain larvae (Sep. 20).

The guest, *Synergus lignicola*, has been reared from the galls in considerable numbers and also a few parasites belonging to the genus *Eurytoma*.

*Acraspis erinacei* Walsh. (*C. pisum* Fitch.) Galls common in September and October on the leaves of *Q. alba*, usually on the under side. When growing they are of a beautiful rose or straw color and are covered with short spines or hairs. The gall is exceedingly hard when dry and the surface is made up of little seed-like projections, much resembling the surface of a strawberry. The galls seldom contain less than two or more than five larval cells.

The mature insect emerges in November and is wingless, or, rather, with only stubs of wings.

A very common parasite reared from this gall is *Decatoma flava*.

*Biorhiza forticornis* Walsh. (*Cynips ficus* Fitch.) Galls occurring near the tips of the twigs of *Q. alba*, almost invariably on young second growth shoots. A hundred or more are often crowded together about the shoots and appear much like a great number of little compressed sacks. When green they are

light yellow in color, but are brown when dry. Common.

A few undetermined parasites only have been reared.

*Holcaspis globulus* Fitch. Galls globular, from three to six eighths of an inch in diameter, composed of a corky material with an egg-shaped central cell, always occurring on the twigs of *Q. alba*. The fly emerges late in October or early in November.

*Decatoma varians*, an undetermined species of the same genus, and a species of *Eurytoma* have been reared as parasites on this fly. Common.

*Holcaspis rugosa* Bass. The gall and the fly of this species resemble very closely those of *H. globulus*. I have found the galls to be more highly colored than those of the latter species, and when matured they have a shriveled surface, while *globulus* is smooth. These galls have been taken on *Q. prinus* only, and are scarce. One guest, *Synergus ficus*, and the parasites, *Decatoma varians*, *Decatoma* sp., *Eurytoma punctiventris* and *Syntomaspis* sp., have been reared from the galls of this species.

*Holcaspis duricoria* Bass. (*H. mamma* Walsh.) This is probably the gall-fly referred to by Walsh in a foot-note in the *American entomologist*, vol. 1, page 102, for which he suggests the specific name *mamma*. Mr. Bassett described this insect and gave it the specific name *duricoria*, a name that has been accepted by European entomologists. For this reason, and for the farther reason that Walsh's description is not sufficient to distinguish the species with any certainty, I have given Bassett's name the preference.

The galls are very common on the twigs of *Quercus bicolor* and *Q. macrocarpa*. They may appear singly but are usually crowded together in clusters about the twigs. The galls, unless much crowded in the cluster, are sub-globular in outline with a small teat-like projection. The fly, which much resembles *H. globulus*, *H. rugosa* and *H. Bassetti*, began to appear in the breeding cages Oct. 27. Fig. 3 is a full size representation of a cluster of these galls.

Two parasites, *Decatoma varians* and *Ormyrus ventricosus* were reared from this species.

*Dryophanta papula* Bass. These galls have been taken on *Q. rubra* and *Q. coccinea*. They consist of thickened portions of the leaves that are raised in many sharp points on the upper side. These thickened portions are lighter in color than the surrounding parts of the leaf and each little point seems to mark the location of the larval cell. Flies began to appear July 12. Rare.

The great majority of insects reared from these galls have been parasites of the genus *Tetrastichus*.

*Neuroterus noxiosus* Bass. The galls are irregular swellings of the twigs of *Q. bicolor*. Galls taken in January gave the mature insects the last of March following. Galls not at all common.

The guests *Synergus lignicola* and an undetermined species of the same

genus were reared. A number of the parasite, *Ormyrus minutus*, were also reared.

*Neuroterus vesicula* Bass. When the larva of this species is full grown the gall is a thin shell, globular in form, almost black in color, covered with light spots, does not exceed three mm. in diameter and is supported by the bud scales of *Q. bicolor* and *Q. macrocarpa*. Galls taken April 29 gave flies May 3.

Neither guests nor parasite were reared.

(*To be continued*)

## NOTES ON THE PARASITE OF THE SPOTTED LADY-BEETLE (*MEGILLA MACULATA*).[1]

BY CLARENCE MOORES WEED AND CHARLES A. HART.

Our attention was first called to this subject during the summer of 1884 when dead examples of the common spotted lady-beetle (*Megilla maculata*) were found by Mr. Hart on various plants, each having beneath or beside it a compact brown cocoon, about 4 mm. long by 2 mm. wide. The matter was not especially studied at that time, and no further attention was paid to it until 17 July 1885, when several examples of the same kind were found in a cornfield. The lady-beetles were in two cases dead, while in three or four others they were alive and embracing the cocoon with their legs. One of the cocoons attached to a dead beetle had a cap removed from one end, the parasite having doubtless escaped through the opening thus made. The other cocoons were placed in a breeding cage, and the imagos were bred from them.

A living specimen of the same lady-beetle was again found 5 August 1885 on corn, at the base of a leaf, with a cocoon of its parasite entangled in its legs. It was retained alive for examination and acted much as a spider does about its egg-sack. When found, its hind claws were caught in the loose silk of the cocoon, but when the cocoon was removed the lady-beetle seemed greatly disturbed, and would fold its legs about anything within reach. It walked holding its body high in the air, and when it came in the vicinity of the cocoon, its claws would become entangled so that it dragged the cocoon along after it. When placed upon its back it waved its feet

[1] The present paper is mainly an abridgement of a more elaborate one prepared for the Cleveland (1888) meeting of the Entomological club of the American association for the advancement of science (the title of which was sent to the secretary) but as I was unable to reach Cleveland before the club adjourned it was not read. Since the meeting, however, an article covering the main grounds of our paper has been published in *Insect life* (Oct. 1888, v. 1, p. 101-104) by Dr. Riley, but it has been thought worth while to present these additional observations upon the presence and habits of the parasite and its host in Illinois, where all the observations here recorded were made, as a part of the work of the Illinois State laboratory of natural history.

C: M. W.

excitedly as most insects do when in this position; but as soon as the cocoon was placed within reach, it folded its legs about it and became quiet, remaining so although still lying on its back.

Early in May 1886, another *Megilla* was found over a cocoon on a clover leaf, and was transferred to a breeding cage. When next examined, 26 May, the parasite had emerged and the beetle was dead, although still entangled in the cocoon.

Again 18 May 1886 another *Megilla* was found on a currant leaf clinging to a cocoon like those above mentioned. It strongly resisted efforts to dislodge it, and refused to walk when removed — clinging to the leaf-stem or other small object as it had done to the cocoon. No sign of external injury could be seen. When put in alcohol the beetle refused to let go the cocoon until dying.

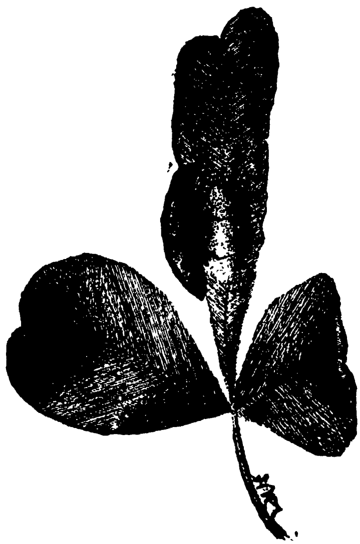
The same kind of beetle and cocoon were again found by a member of the Natural history society of the University of Illinois at a field-meeting in May 1887, in the woods near Mahomet, in central Illinois, and was shown to most of the members present. The *Megilla* was alive and clung to the cocoon with great pertinacity.

The accompanying illustration, drawn by Miss Lillie Hart, shows the beetle over the cocoon, on a clover leaf.

### Description.

The parasite bred by us agrees with the figure given by Dr. Riley of the species bred by him from this coccinellid, for which he has proposed the provisional name *Centistes americana*. He had obtained only female specimens, however, while both sexes are represented in the Laboratory collection. The two sexes may be described as follows:

Length, 2.5 mm. ♂ ♀. Black, somewhat shining, covered with rather long brown hairs; head with palpi and mandibles yellowish brown; black on vertex surrounding ocelli. Abdomen, except tergum of first segment, shining, dark



brown. Antennae as long as body, piceous except at base where they are tawny olive. Mesonotum coarsely punctate, with subtriangular areas adjacent to the insertion of the wings more shining and with fewer punctures; these areas sometimes brownish. Metanotum coarsely reticulate. Tergum of first abdominal segment longitudinally rugosely reticulate, remaining segments smooth and shining. Legs of ♀ dark yellowish

brown, with coxae blackish, and tarsi together with intermediate and posterior femora, obfuscate. Legs of ♂ lighter colored, with coxae unicolorous with legs; posterior tibiae at tip, and posterior tarsi dusky. Tegulae piceous. Wings subhyaline; veins and stigma deep brown. Ovipositor nearly as long as abdomen; sheaths piceous.

Described from four specimens (3 ♀, 1 ♂) bred from cocoons found in connection with *Megilla maculata*.

The cocoon is of a clear reddish brown color, 4 mm. long by 2 mm. wide. Its texture is compact, except that there is considerable loose silk on the outside.

## COSMOPOLITAN BUTTERFLIES.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

Strictly speaking, there is no such thing as a cosmopolitan butterfly; yet there is one species, *Vanessa cardui*, which may well merit that name, since it is found in every quarter of the globe with the exception of the arctic regions, a part of South America and most of the West India islands; there are also other butterflies whose recent extension naturally leads to the inquiry, What should prevent their spreading over the entire globe, or what are the elements that enable a butterfly to gain and maintain a foothold in so many diverse regions.

Let us look for a moment at the peculiarities of distribution of this nearly cosmopolitan butterfly. It belongs to a subdivision of the genus *Vanessa*, the members of which (with the sole exception of this cosmopolitan species) are found exclusively in the New World; while the antithetical section (with the single exception again of one member found both in Europe and the United States) is exclusively confined to the Old World. Judging from this fact we may venture to assert with considerable confidence that this cosmopolitan butterfly originated in America. *Yet it is just on this continent that its distribution is most limited!* It is known in only a comparatively small portion of South America and occurs on none of the West India islands, with the exception of Cuba, where it is rare. The cause of this limitation cannot be attributed to the food plant of the caterpillar; for the thistles upon which it lives are quite as abundant in these regions as in many others which it has invaded, certainly sufficiently abundant for all its uses. Nor can the heat of the tropics be placed as a difficulty in the way, since there is no place where it flourishes more abundantly than in the tropics and subtropics of the Old World, repeated invasions of Europe by hordes from the south where they had outgrown their opportunities being already on record.

Assuming, then, America to have been its original home, it would seem

as if we might fairly conclude that a butterfly of a dominant type, after its distribution in the region of its birth had reached its limits (the balance between the competitors in the struggle for existence being fairly struck), on being introduced into a new world, where it had to contend in the struggle for supremacy with none of the members of its own restricted group, which had stood in its way in its native home, would suddenly find that it had reached a region ready for conquest and would spread therein with such success as to completely overrun that division of the world.

That this is a probable picture of events which actually transpired in this instance, the result of which we see to-day, is rendered more probable by other events which have taken place under our very eyes, which, though not strictly parallel, seem to have a lesson. *Pieris rapae*, originating in the Old World among a circle of relatives far greater than exists in North America, relatives whose natural food plant is precisely its own, has been suddenly transported to America, where the group to which it belongs is much more poorly represented in species, all feeding upon plants of the same family; and though there are among them species of the genera *Pontia* and *Pieris* having intimate relationship with forms which have more or less successfully contended with *rapae* in their own home, the inexperience of the American species with such a rude antagonist has made them no match for it; so that in the mere quarter of a century since its introduction it has spread over half the territory of the United States, doing now vastly more injury than all the others of its own tribe combined and contending with them so successfully that their scarcity where formerly abundant is everywhere noticed. In this latter instance commercial agencies are amply sufficient to explain the introduction of this butterfly into our country. It is, however, an insect dependant upon a group of food plants which forbid its passage into the tropics and so will prevent its spread over more than the north temperate zone.

It is plain that no butterfly can become cosmopolitan whose caterpillar does not feed upon plants found in all quarters of the globe. Yet this is plainly not a sufficient cause for distribution. As a proof of this it may be pointed out that one of the most polyphagous of our butterflies, *Jasoniades glaucus*, which has an unusually extended distribution in North America, where it has several allies, has never become cosmopolitan; while plants to which it might easily adapt itself are found in every quarter of the globe. Moreover, the alliances of the genus are wholly with tropical American forms and its ancestors unquestionably originated in that part of the world; yet the genus is not found in the tropics. Nor has it ever spread to the Old World; at the same time there are other genera of the same tribe, not distantly related, which do possess members in both the New and Old Worlds, whose food is of a much more restricted range; such are the genera *Iphiclides* and *Papilio*.

We have another instance of possible cosmopolitanism which is perhaps more

remarkable than any of the others, in the spread, known to be recent, of *Anosia plexippus* which feeds only upon *Asclepiadaceae*, a group of plants found all over the world in temperate and torrid regions. It is remarkable, because *Anosia* belongs to a section of the subfamily nearly all whose other members belong to the Old World, and yet it is in the Old World that it is now achieving its success. In ancient times, some offshoot of the Old World type found its way to the new continent, spread and multiplied, so long a time ago as to have now become differentiated into several different species and genera, one of which, reintroduced through commercial agencies into the home of its forefathers, bids fair to rival its ancient allies. Here then we have a butterfly which may yet become as cosmopolitan as *Vanessa cardui* is to-day, or only less so from its inability to perpetuate itself in regions with severely cold winters.

I do not find among our butterflies any other instance which seems to me likely to aspire to similar honor. But it may be pointed out that *Pieris rapae* is by no means so destructive in Europe as is another butterfly of the same group, *Mancipium brassicae* whose caterpillars, being semigregarious, are capable of much more mischief. Should this butterfly be transported to America (and its chances of such transportation seem to be equally good with those of *Pieris rapae*), it would probably outdo the ravages of *Pieris rapae* and spread as far as it.

Considering the relative abundance in individuals of the species of *Rhodoceridi* above that of those of any other tribe of butterflies, the prevalence of *Eurymi* in the north temperate regions, and that of *Callidryades* in the tropics of the New World, it seems a little surprising that we have among them no single species which has a range at all extraordinary, and no example of widespread distribution through two hemispheres. At least such must be the judgment of one who cannot look upon two forms having an entirely different development in two hemispheres, as holding any right to be considered otherwise than as now distinct species. But there are others who claim an identity of species between some of the forms of *Eurymus* on the two northern continents. In one case, indeed, it would appear that one of our common species of *Eurymus*, *E. philodice*, was introduced by some accident into England, and flourished there for a brief while, but speedily became extinct.

It seems almost equally surprising, considering the dependence of insects upon their food plants, that we find not a single instance of any remarkable distribution among butterflies feeding in their caterpillar state upon *Leguminosae* or upon grasses, although a very considerable number of butterflies affect these particular groups. It is, therefore, plain that besides the universal distribution of its larval food plant, something more is needed to open before any butterfly the possibilities of a cosmopolitan life.

# NOTES ON THE EPIPHARYNX, AND THE EPIPHARYNGEAL ORGANS OF TASTE IN MANDIBULATE INSECTS.

BY ALPHEUS SPRING PACKARD., PROVIDENCE, R. I.

Réaumur was, so far as we have been able to ascertain, the first author to describe and figure the epipharynx, which he observed in the honey bee and bumble bee, and calls *la langue*, remarking that it closes the opening into the oesophagus, and that it is applied against the palate.[1] According to Kirby and Spence,[2] DeGeer[3] described the epipharynx of the wasp: and Latreille[4] referred to it, calling it the *sous labre*.

The name epipharynx was bestowed upon this organ by Savigny,[5] who thus speaks of that of the bees: Ce pharynx est, à la vérité, non-seulement caché par la lèvre supérieure, mais encore exactement recouvert par un organe particulier que Réaumur a déjà décrit. C'est une sorte d'appendice membraneux qui est reçu entre les deux branches des mâchoires. Cette partie ayant pour base le bord supérieur du pharynx, peut prendre le nom d'*épipharynx* ou d'*épiglosse*.

He also describes that of diptera What Walter[6] has lately proved to be the epipharynx of lepidoptera, was regarded by Savigny and all subsequent writers as the labrum.

The latest account of the function of this organ is that by Cheshire, who states that the tube made by the maxillae and labial palpi cannot act as a suction pipe, because it is open above. "This opening is closed by the front extension of the epipharynx which closes down to the maxillae, fitting exactly into the space they leave uncovered, and thus the tube is completed from their termination to the oesophagus."

It is singular that this organ is not mentioned in Burmeister's Manual of entomology, in Lacordaire's Introduction à l'entomology, or by Newport in his admirable article *Insecta* in Todd's Cyclopedia of anatomy.

Neither has Straus-Durckheim referred to or figured it in his great work on the anatomy of *Melolontha vulgaris*.[8]

In their excellent work on the Cockroach, Miall and Denny state that "The epipharynx, which is a prominent part

[1] Réaumur, Mémoires pour servir a l'histoire des insectes, v. 5, 1740, p. 318. pl. 28, figs. 4, 7, 8, 9, 10, 11 *l*.

[2] Kirby and Spence, Intr. to entomology, v. 3, 1828, p. 457.

[3] De Geer, v. 2, 1778—v. 26, fig. 11. M. (Kirby and Spence, pl. xii. fig. 2 K.)

[4] Latreille, Organization extérieure des Insectes, p. 184. (Quoted from Kirby and Spence.)

[5] Savigny. Mémoires sur les animaux sans vertèbres. Partie 1re, 1816, p. 12.

[6] Walter, Alfred, Beitge zur morphologie der schmetterlinge. Erster thel. Zur morphologie der schmetterlingsmundtheile. (Jena. Zeits., v. 18, 1885, p. 752.)

[7] Cheshire. Bees and bee-keeping. I. London, 1886, p 93.

[8] Considérations générales sur l'anatomie comparée des animaux articulés, 1828.

in coleoptera and diptera, is not recognizable in orthoptera." (p. 45.)

I am not aware that any modern writers have described or referred to the epipharynx of the mandibulate orders of insects, though I must confess that I have not made extended search after such references and I would be thankful for information and references. Although Dr. G. Joseph[9] speaks of finding them on the palate of almost every order of insects, especially plant-feeding forms, we are unable to find any specific references, his detailed observations being apparently unpublished.

The epipharnyx is so intimately associated with the elongated labium of certain diptera, that, with Dr. Dimmock,[10] we may, refer to the double organ as the labrum-epipharynx; and where, as in the lepidopterous *Micropteryx semipurpurella*, described and figured by Walter,[11] and the *panorpidae*[12] (*Panorpa* and *Boreus*), the labrum seems pieced out with a thin, pale, membranous fold which appears to be an extension of the epipharynx, building up the dorsal end of the labrum, this term is a convenient one to use.

In the lower orders of truly mandibulate insects, from the thysanura to the coleoptera, excluding those which suck in liquid food, such as the diptera, lepidoptera and hymenoptera, and the mecaptera (*Panorpidae*) with their elongated head and feeble, small mandibles; the epipharynx forms a simple membranous palatal lining of the clypeus and labrum. It is not, so far as we have observed in any mandibulate insects in which the mouth parts are free, adapted for mastication only, the mandibles being well developed,—in such insects there is no soft projecting or pendant portion, fitted to close the throat or to complete a partially tubular arrangement of the first and second maxillae.

In all the forms, then, described below, the epipharynx forms simply the under surface or pharyngeal lining of clypeus and labrum, the surface being uniformly moderately convex, and corresponding in extent to that of the clypeus and labrum, posteriorly merging into the palatal wall of the pharynx; the armature of peculiar gathering-hairs sometimes spreading over its base, being continuous with those lining the mouth and beginning of the oesophagus. The suture separating the labrum from the clypeus does not involve the epipharynx, though since certain gustatory fields lie under the front edge of the clypeus, as well as labrum, we may in describing them refer to certain fields or groups of cups or pits as occupying a labral or clypeal region or position.

In our descriptions we have called attention to the shape of the front edge of the labrum, whether notched or not, and whether bearing traces of a median suture, on account of the bearing of these parts on the question whether the labrum

9 Joseph, Gust, Zur morphologie des geschmacksoganes bei inseckten. Amtlicher bericht der 50 verrsammlung deutscher naturforscher u. Artzte in München. 1877, p. 227–228.

10 Dimmock, George. The anatomy of the mouth-parts and of the sucking apparatus of some diptera 1881.

11 *Op. cit.*, fig. 3

12 Packard, A. S. Psyche, 1889, v. 5, p. 159-164.

represents a first pair of antennae. The lack of traces of a suture in the epipharynx corresponding to the labral suture above, suggests that the labrum does not represent a pair of coalesced appendages, and that it, with the clypeus, simply forms the solid epidermal roof of the mouth.

The only soft structures seen between the epipharynx and labrum besides the nerves of special sense, are the elevator muscles of the labrum and two tracheae, one on each side.

The structure and armature of the epipharyngeal surface even, besides the taste-pits, cups and rods, is unexpectedly varied, the setae assuming very different shapes. There seems to be two primary forms of setae, (1), the normal forms which arise from a definite cell, the setae being a hypertrophied nucleus, as first shown by Newport, and (2), soft, flattened, often hooked hairs which are cylindrical toward the end, but arise from a broad triangular base, without any cell-wall, not arising from distinct nuclei. These are like the gathering hairs (Cheshire) on the bee's and wasp's tongue; they also line the walls of the pharynx and extend toward the oesophagus. They are the "hooked hairs" of Will. The first kind or normal setae are either simply defensive, often guarding the sense-cups or sensory fields, or they have a nerve extending to them and are tactile.

It will be seen by the following descriptions that in the thysanura no true gustatory cups or pits have been found; and that immature dermaptera are destitute of them. On the other hand taste-cups occur on the epipharynx of the larvae of longicorn, scarabaeid and buprestid beetles, and they are as abundantly developed in carabid or carnivorous beetles as in plant-eating coleoptera. Also, within the limits of a family like the *locustidae* they are less abundant in one of the more generalized genera as *Xiphidium*, and more numerous in a highly specialized genus, as *Cyrtophyllus*.

I should say that I have examined the taste-cups of the honey bee, finding that they agree with Wolff's figures, and that those of insects of the orders described below are essentially of the same structure and all seem by situation to be gustatory in function.

Order Thysanura.

*Lepisma* sp. from Havana. — The specimen examined was one of a number kindly collected for me by the venerable Professor Poey of Havana in his own house. The labrum is slightly excavated along the entire margin, but there is no trace of a median suture; and over the surface, are scattered long acute hairs, while at the base and over the clypeus are thickly planted, singular long setae which are hairy beyond the middle, and are forked at the end.

The epipharynx ends in front in a broad median lobe somewhat as in *Forficula*, the edge of which bears numerous very short cylindrical rods, whose presence can only be distinctly made out by a power of 400 diameters. This lobe is also covered with an exceedingly

fine pile consisting of acutely lanceolate hairs arising from a broad, non-nucleated base; those on the sides, especially in front, being directed towards the middle of the epipharynx, and much coarser than those situated farther back.

There is no median furrow, and no sense-pits, cups or rods, the median region being clothed with fine hairs.

*Machilis variabilis* Say.—The shape of the labrum and epipharynx is very singular. The labrum is narrower than long, the front edge slightly excavated, and provided with a row of short, stiff, broad, flat setae, which end in a short fork. There are no traces of a median suture.

The epipharynx has no separate median frontal lobe like that of *Lepisma*, but the broad edge simply forms the under surface of the labrum. The edge is provided with a singular armature of about four rows of short thick appressed spines, whose ends turn down a little, so that they appear like four rows of somewhat polygonal paving stones; each has a central nucleus. I can perceive no setae arising from them. Whether these singular shortened and curved rods are gustatory, or in any way sensory, or whether simply defensive, remains to be proved; I could not detect any nerves leading to them. From each side of the end of the epipharynx two series, in oblique rows, of somewhat appressed, rather large, short conical setae, with a nucleus at the end, curve inwards along the distal third of the epipharynx, and thence extend parallel to each other towards the base of the epipharynx. Of these conical setae, those in front when examined with a power of 400 diameters do not appear to bear a bristle, though there is a nucleus at the end; but many of those situated farther back bear a long acute bristle. There is no median furrow, but the median region is very finely pilose, the fine hairs becoming more numerous at the base and extending along the epipharyngeal lining of the clypeus. No genuine sense-pits, cups or rods could be detected.

### Order Dermaptera.

*Forficula* sp. from Cordova, Mexico. —The labrum is rounded in front with no traces of a median suture.

Epipharynx with a membranous edge in front, fringed with a dense row of short fine setae, and just within the edge are two or three rows of sinuous, slender, blunt setae, of peculiar shape, which may be possibly gustatory. The surface is covered with very fine scale-like setae, and on each side near the base is a region covered by a short dense pile.

The taste-pits are few in number, there being only about a dozen on each side in all; most of them being situated on the anterior half, and a few near the base. The taste-pits are provided each with a short fine seta, as usual, arising from the centre.

*Forficula larva* from Florida. — The front edge of the labrum is entire, rounded, and there are no traces of a median suture. The front edge of the epipharynx forms a slight projection or lobe, about half as wide as the labrum, which is fringed with fine setae, some

of which are hair-like, acute, while others are blunt and curved. The surface in general is covered with the usual fine pile. The median area is bordered by a pile-covered area, but along this region no sense-pits, cups, or rods could be detected with a power of 400 diameters; over the region where they usually occur were to be seen scattered conical setae.

### Order Orthoptera.

*A wingless Blattid* from Florida. —The labrum is full and rounded on the front edge, with no indications of a median suture. The surface of the epipharynx is finely and densely pilose. There are no sense pits, cups or rods visible.

*Blatta*, a large winged species from Cuba. — Front of the labrum slightly excavated. The epipharynx is provided on the front edge with very numerous short, stout, minute setae, which are curved downward, and form when looked at vertically, a pavement-like mass; beyond on the extreme edge is a dense fringe of short slender rod-like bristles. The surface elsewhere is finely pilose, the median region not being bare. On each side of the middle is a curved row of stiff defensive spines; at the distal end of each row is a sensitive field, containing 20 taste-cups on one side and 23 on the other. Near the front edge of the clypeal region are two more sense-fields, situated on each side of the median line, there being 35 taste-cups in each field. The taste-cups in this species are rather smaller than usual.

*Spectrum bivittatum* Say. — In a specimen from Indian River, Fla. the front edge of the labrum is entire, but along the middle are traces of a median suture. The middle region of the epipharynx, and the epipharyngeal lining of the clypeus are covered with fine and coarse setae, but there is no bare space, and no sense-pits are to be detected. (Those that at first appear to be such are ordinary cells with the setae broken off.)

*Camnula pellucida* Scudd.— The labrum is notched, but the edge is plain, not bearing any rods or bristles on the border of the excavation, or elsewhere on the labral margin. There is a well defined short median suture in the middle of the labrum which sends posteriorly two forks.

The epipharynx is free from hairs along the middle, and near what corresponds to the front edge of the clypeus, are two sensitive fields, each containing about 35 taste-pits. Just in front under the suture between the clypeus and labrum are two similar fields, each containing from 40 to 42 taste-pits. There are none in front of these.

*Xiphidium brevipennis* Scudd. ♀. —The epipharynx is slightly notched at the end in the middle and the sinus filled with slender setae. The median line forms a slight furrow, while the surface of the epipharynx in general is covered with fine rather stiff short setae.

Along each side of the median line on the anterior half of the epipharynx are scattered about 30 taste-cups, mostly without, but some bearing rather large and long setae. At the base is a scat-

tered group of seven taste-cups on each side of the base of the median furrow, nearly all bearing a bristle, but some not; all are so isolated from the other true hairs that they are most probably gustatory. On each side of the region corresponding to the front edge of the clypeus is a group of about 30 taste-cups, only one or two of the outer ones of which seem to bear a bristle.

*Cyrtophyllus concavus* Scudd.—End of the labrum notched and the sinus filled in with stiff blunt bristles, this area extended back on the epipharynx; there are distinct traces of a median suture. Along the middle of the epipharynx the spines are absent. The taste-cups are arranged much as in *Xiphidium*, but they are more numerous, as might be expected, this genus being in general the more specialized. There are from 50 to 60 taste-cups in the front region; behind the middle a group of 25 on each side, and over an area corresponding to the base of the labrum and front edge of the clypeus is a sensory field with about 70 taste-cups, on each side. They are true cups or beaker-like papillae, some with a fine, others with a short, stout, conical seta. The katydid is thus provided with about 170 to 180 taste-cups on its epipharynx.

*Anabrus simplex* Hald.—Front edge of the labrum full, though there are traces of a median suture. The surface of the epipharynx is covered with stout setae. Along the median furrow of the epipharynx which is bordered with a delicate pile, are scattered, especially near the base, a few peculiar taste-cups, each bearing a very short conical seta, which is larger and shorter than usual the furrow not being pilose. At a point situated near the anterior edge of the clypeus the heavy spines towards the middle graduate into what appear to be sense-cups.

*Ceuthophilus maculatus* (Harris).—Labrum slightly excavated. Surface of the epipharynx finely pilose. Front edge at the middle forming a highly specialized pilose area, excavated on the edge, the sinus being broad and shallow and the edge lined with a hedge-like row of close-set gustatory rods. A well marked median furrow, free from hairs or bristles, and in front is a group, 30 on each side of the median line, of raised papillae—like taste-cups, a little shorter and broader than those of *Hadenoecus*. At the base of the labral region on each side of the median line is a sensory field of 25 taste-cups arranged in quite regular rows. On the anterior clypeal region is a group of 9 or 10 scattered taste-cups which are shorter, more like cups and far less numerous than in *Hadenoecus*.

*Hadenoecus subterraneus* Scudd.—In specimens from White's Cave near Mammoth Cave, Ky., the front edge of the labrum is peculiar from the very deep, narrow median pouch-like sinus, which enlarges towards the bottom, and opens out on a median projection, which, as well as the sinus, is fringed with coarse spines, which at the mouth of the sinus become curved. The taste-cups are highly developed in this cave-cricket, being rounded papillae with the

nucleus at the top or end. They are grouped on each side of the middle near the front edge, there being 25 on each side. An irregular row of these cups extends along each side, some occur under the base of the labrum, but they are most numerous on a field corresponding to the front edge of the clypeus, there being 50 on each side, or 100 in all, where in *Ceuthophilus* there are only 9 or 10.

The gustatory cups being so much longer, better developed and much more numerous in the cave *Hadenoecus* than in *Ceuthophilus*, which lives under stones, etc., out-of-doors, it would seem as if the sense of taste were much more acute in the cave-dweller than the out-of-doors form, though it does live for the most part in twilight.

*Conocephalus ensiger* Harris, ♀.—The epipharynx is full in front, with a deep, narrow, median furrow or gutter along which the liquids probably pass into the throat. At the end is a fringe of fine bristles. On the clypeal region there are about 25 taste-cups, a few projecting over the edge of the gutter; a few more are scattered along the gutter to near the end of the labrum.

*Gryllus* sp.—In the common black cricket the labrum is rounded in front with a median excavation, the sinus being fringed with rather long, stout, flat, truncated setae, which are longer on the sides than in the middle. There are traces of a longitudinal suture.

The surface of the epipharynx is covered towards the front with fine hairs; on the sides in front are large coarse spines, and at the base is a large area covered with coarse, defensive spines, directed inwards towards the median furrow, which is free from setae.

Taste-cups are abundant; in front, at some distance from the front edge is on each side a group of conical rounded cup-like papillae, carrying the nucleus at the top, there being about 30 arranged in four very regular rows. Nearer the middle is a group, on each side of the middle of the furrow, of 8 taste-cups which are situated just in front of the ends of two curved tracheae. On the outside of the tracheae is a linear group of about 60 taste-cups extending from the base to near the isolated group of 8 cups. Another sensory field containing 45 taste-cups on each side of the median line, or 90 in all, scattered over the area, is situated under the nose of the labrum and front edge of the clypeus, most of them behind the labrum. There is also a lateral group of about 14 taste-cups on the outer edge on the front region of the clypeus and situated outside of the base of the curved tracheae. The sides of the epipharynx under the clypeus are clothed with fine "gathering" or "hooked hairs."

*Oecanthus niveus* Serville ♀.—The shape of the labrum and epipharynx, as well as the number and distribution of the taste-cups, are almost exactly as described in *Conocephalus ensiger*.

(*To be continued.*)

## ENTOMOLOGICAL NOTES.

Entomologist for Minnesota. — A recent number of *Entomologica americana* states that Mr. Hermann Oelrichs is the entomologist of the Minnesota experiment station. This is a mistake as Mr. Otto Lugger the original appointee still holds the position.

Colorado biological association.—The reorganization of the Colorado ornithological association under the above name is announced. Mr. T. D. A. Cockerell, the secretary of the newly organized society, has already written many articles on North American insects for English and American entomological journals, and is at present engaged on a "Bibliography of Colorado entomology" for the new association. *G: D.*

Spider poisons. — Professor Breeger has recently investigated the poisons of spiders. He found that the Russian varieties of spider, *Phalanchium* and *Trochosa* (tarantula), are non-poisonous, but that a third, *Caracurt* or "black wolf," secretes a powerful poison, forming 25 per cent of its whole weight. This substance is a peculiar unstable alkaloid, destroyed at 60° C., or by alcohol. Introduced into the circulation of warm-blooded animals, one-thirtieth of a milligram per kilogram of the animal treated was sufficient to cause death. It exceeds in power all known vegetable principles, and prussic acid being comparable in toxicity with the poison of snakes. — *Sci. american*, 17 Nov. 1888, v. 59, p. 310.

New scientific journal.—Contributions to science by Charles J. Maynard, a new quarterly (No. 1, April, 1889) published by the author at Newtonville, Mass., contains a description with figures of the defensive glands of *Anisomorpha buprestoides*.

G. D. Smith collection of beetles.—Mr. F. C. Bowditch has purchased the large and valuable cabinet of beetles formed by the late Mr. George D. Smith of Cambridge, Mass. According to an enumeration made several years ago by Mr. B. P. Mann, this collection contained more than 8900 species and 37,000 specimens. With this addition Mr. Bowditch's collection ranks among the largest in this country.

Agricultural experiment station reports. — The Cambridge Entomological Club desires to obtain as full sets as possible of all reports of state experiment stations established under the Hatch bill, in so far as these reports contain entomological matter. Up to the time of writing the librarian has received bulletins from the states indicated by an asterisk below. For the benefit of our subscribers we append a list, as accurate as we can now make it, of the addresses of those stations that have entomologists. We should be glad to receive additions and corrections for this list.

| *State.* | *Entomologist and address.* |
|---|---|
| Maine. | Prof. F. L. Harvey, Orono. |
| Vt. | Prof. G: H. Perkins, Burlington. |
| Mass.* | Prof. C: H: Fernald, Amherst. |
| N. Y.* | Prof. J: H: Comstock, Ithaca. |
| N. J. | John B. Smith, New Brunswick. |
| Del.* | M. H. Beckwith, Newark. |
| Va. | W: B. Alwood, Blacksburg. |
| S. C.* | Prof. G: F. Atkinson, Columbia. |
| Geo. | J. P. Campbell, Athens. |
| Miss. | Prof. S. M. Tracy, Agricultural College. |
| Tex. | M. Francis, College Station. |
| Mo. | J. W. Clark, Columbia. |
| Ark. | C: W: Woodworth, Fayetteville. |
| Tenn. | H: E. Summers, Knoxville. |
| Iowa.* | C. P. Gillette, Ames. |
| Minn.* | Otto Lugger, St. Anthony Park. |
| Dak. | J. H. Orcutt, Brookings. |
| Mich.* | Prof. A. J: Cook, Agricultural College. |
| Ohio.* | C. M. Weed, Columbus. |
| Ind. | F. M. Webster, Lafayette. |
| Neb. | Lawrence Bruner, Lincoln. |
| Kans.* | Prof. E. A. Popenoe, Manhattan. |
| Cal. | F. W. Morse, Berkeley. |

No. 153 was issued 11 Jan. 1889.
No. 154-155 were issued 8 March 1889.

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 157-159.**

MAY-JULY 1889.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

**YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.**

**[Entered as second class mail matter.]**

# THE FEMALE OF EUTERMES RIPPERTII.

BY HERMANN AUGUST HAGEN, CAMBRIDGE, MASS.

**The ovarium of the imago.**

The dark colored, mature-winged imago, taken out of the nest *before* swarming (therefore before copulation) was dissected. The color of the ovarium is pale and whitish. Each ovarium is connected within the ends of the metathorax with the dorsal vessel by a very fine filament. The end of the filament measures only .003 mm. in thickness, and in the middle between the insertion and the sudden dilatation of the ovarium the filament is .023 mm. in thickness. Each stigma sends a very large bundle of tracheae to the external part of the ovarium. Where the first bundle reaches the ovarium a rounded dilatation is to be seen, and from here the ovarium increases slightly. Nevertheless, its thickest part, just before the oviduct, though containing some eggs in an advanced stage of development, is only .512 mm. in thickness. The internal half of the whole length of the ovarium is somewhat paler and consists apparently of the filaments of the egg tubes, one running very near to the other, without any twisting and all so closely connected, that a separation is impossible. I was not able to observe in this internal part any tracheae. The external part is visibly darker and provided with very numerous tracheae. The bundles of the tracheae reach the ovarium in a horizontal direction in the beginning of the abdomen; those that follow go obliquely from behind forward to the ovarium, and rise there from a single main stem of .118 mm. in diameter, while the two bundles in the beginning of the abdomen rise from two or three smaller main stems. Just before reaching the ovarium, the main stem of the tracheae is suddenly divided into very numerous smaller branches, which enter the ovarium, divide again like a braid between the filaments and are curved there to provide the interior of the ovarium. Some remain externally on the superficies of the ovarium, and are divided into very fine branches running in an irregular, meandrous manner. The finest I was able to measure, were .003 mm. in thickness. Following the last attached bundle, the ovarium is pear-shaped, dilated, the egg tubes visible and dilated, and filled with a number of eggs, the largest ones, a dozen or more, of dark amber color and of the

same size as the ripe eggs of the queen. The size of the eggs before these diminish rapidly; only eight or nine were developed, and very similar to those in the queen; the three eggs in advance of the last one are darker with a series of elongated cells on each side; those before them shorter, nearly quadrangular, paler, all with a germinal vesicle and dot. Then come very small compartments, with egg-cells in transversal rows and farther on irregular cells in large numbers and very near together. The oviduct is inserted on the inferior end of the ovarium, just on the centre of its inferior end, first somewhat enlarged, then cylindrical, .157 mm. in thickness, and .641 mm. in length to the point, where it meets the oviduct of the opposite side; both forming together from here the large oviduct. The egg-canal in the centre of the ovarium does not reach beyond the point where the first (near the tip of the abdomen) bundle of tracheae is attached, and increases therefore later in length by the successive development of the ovarium.

**The ovarium of the queen.**

A queen of *Eutermes rippertii* .24 mm. in length, the abdomen .20 mm. long and .08 mm. in thickness, was dissected. After removing the dorsal part of the skin the whole abdomen appeared to be filled by the two ovaria. The queen was perhaps an old one, as there was very little fat along the outer side of the ovarium. In a queen of *Termes gilvus* and in another of *E. rippertii* a large layer of fat very richly provided with tracheae was found outside along the ovarium. Probably this fatty layer had been used up by the dissected queen of *E. rippertii*, as the rich net of tracheae was connected more closely below with the ovarium.

Each ovarium seen from above is a large cylinder, and both are placed so close together, that only a small median furrow for the dorsal vessel remains above between them.

The whole surface of the ovarium is light yellow and consists of very small egg tubes, beginning seemingly on the inner border of the ovarium, and forming bundles in the shape of flattened braids, running backward somewhat and later incurved outwards, winding down to the under side of the ovarium.

The basis of the ovarium near the end of the abdomen is thick, rounded and globular. The apex of the ovarium near the thorax follows strictly the outline of the abdomen, is somewhat globular but on the top has a more contracted part, adapted to the smaller size of the first abdominal segment. This part consists also of braids of egg tubes, arranged similarly to the parting of the hair. A small, cylindrical, yellow prolongation situated internally near this part reaches farther into the thorax to the dorsal vessel. This yellow cylinder is short, .139 mm. in thickness and ends with a quadrangular, somewhat handshaped, internal dilatation, concave below, and meeting the similar dilatation of the opposite ovarium. The yellow cylinder is formed of the filaments or thread-like ends of the egg tubes, closely

pressed together. From the external and anterior border of the hand-shaped dilatation a large number of more or less isolated, white, hyaline filaments .008 mm. in thickness, reach farther up to the dorsal vessel. These filaments are empty within, very small nuclei are attached to it externally, and a number of epithelial cells of different size, the largest .01 mm. in diameter, lay near by or around them. I believe that the hyaline filaments are parts of the external coat of the dorsal vessel, torn off by the dissection. Indeed, one or two are isolated, but the larger part form flattened slips. These parts are always very difficult to dissect, particularly in alcoholic specimens. In a large queen dissected by me many years ago, I was fortunate enough to prepare the dorsal vessel without separating the attachment of the ovaria, forming a thicker fatty ring around the whole dorsal vessel, and the same fact was stated to be true with the queen of the honey bee by Dr. Knoch of St. Petersburg.

In another queen of *E. rippertii* the insertion of the ovaria to the dorsal vessel was carefully prepared.

Shortly before the dorsal vessel is inflated to the metathorax to send down the smaller aorta, the filaments of both ovaries are attached to the under side. The attachment is very firm and covered above and below with muscles; therefore, torn-off parts of the dorsal vessel and muscles are retained, forming a somewhat hand-shaped process.

Both filaments are united in a semicircular curve, so that as far as I can observe the two ovaria are fused together. At least I was not able to see any end of the filaments. The winged muscles in which the side vessels are laying (W. Peters Reise nach Mozambique, 1862, Vol. 5, Neuroptera by H. A. Hagen, p. 75, pl. 4 fig. 3) send a triangular bunch above the filament and another below, both inserting partly on the dorsal vessel partly on the filament, originating on each side of the dorsal vessel in an elongated bundle of fat and epithelial cells. I tried polarization to see better the difference between the muscles and filaments without success, the number of the muscular fibres being too large, and strongly mixed by their insertion of the filaments, even running along their interior curved border.

The ovarium seen from the side is near the thorax only half as thick as near the end of the abdomen; it is gradually enlarged, the basis rounded, globular. The internal side of the ovarium is straight and flattened, as both ovaria are very near each other. The yellowish cylinder of the apex of the ovarium is prolonged along the internal side in a yellow flattened band 1 mm. broad, running in a straight line a little below the upper border of the ovarium, which is convex and formed by the beginning of the braids. Therefore when the bands of both ovaria are laying close together, there is always left above them a small groove for the dorsal vessel. The inferior border of the band is straight, very sharp and separated somewhat from the ovarium. The band has entirely the shape and the appearance of a tendon, which towards

the end of the abdomen is divided into divergent and downward bent branches. The band as well as its cylindrical, apical prolongation is formed by the fine filaments of the egg tubes very closely pressed together. There does not exist a separate thread beginning at the base of the abdomen and united with the filaments of the following tubes, as observed by Mr. Stein in other insects. So far I was able to follow the filaments each of them is prolonged to the apex, all running together. I was not able to find a connection in a loop of the ends of the filaments, as observed by Mr. Leydig in other insects, but I confess that I was not able to separate the ends, which are very delicate.

The ovarium is covered below the bands with braids of egg tubes just as above, but towards the base tubes with more developed eggs or even ripe eggs begin to be visible and become by and by prevailing. Of course this will be different in young queens; in one of *T. gilvus*, for instance, the whole ovarium was covered with braids, and only after removing them the more developed eggs appeared.

An egg-canal (the beginning of the oviduct) extends through the whole ovarium, the calyx of Dufour and Stein. It is situated in the centre of the ovarium and begins blind near the first segment of the abdomen, runs at first straight, but soon makes a flattened curve downward to the middle of the length of the ovarium, followed by a similar flattened curve upwards. In the last fourth of the ovarium the canal is sloping down, and shortly before the end bent downwards and inwards, and continued in a free, short, cylindrical tube, meeting the canal of the opposite side, where the oviduct begins. This egg-canal is pale yellow and somewhat fleshy, at the beginning .32-.38 mm. in thickness and becomes gradually thicker, towards the end it is .64-.77 mm. It begins as a hollow tube, just large enough to allow the passage of one egg, but the part near the oviduct is always somewhat dilated, when the eggs have to pass through it.

Around the egg-canal the egg tubes are perpendicularly inserted so near each other, that nothing of the outer surface of the egg-canal remains free. Every egg tube is inserted in a short fleshy cylinder, with a concave dish on top, and a hole in the middle, much smaller than the egg. I counted around the blind beginning of the egg-canal six to eight cylinders, but a part taken out of the middle of the ovarium showed about ten to twelve cylinders, very irregularly placed, and about 20 rows in a part of the egg-canal of 4 mm. in length. The cylinders are .3 mm. in length and less thickened. A part of the egg-canal of 4 mm. in length possesses at least 240 cylinders, and as the egg-canal by its curves is longer than the ovarium, there must be at least 1500 cylinders and egg tubes. But as the insertion towards the end of the abdomen is very irregular and closely pressed, I believe even this number is probably too small. The whole substance of the egg-canal is very brittle, at least in alcoholic specimens.

The egg tubes are unequal in length; those nearer to the thorax are the shortest, and inserted directly in the beginning of the egg-canal; those nearer to the tip of the abdomen are the longest, and, being incurved, may be somewhat longer than the ovarium. I think it by no means improbable that the fine filaments of all the egg tubes may reach the dorsal vessel. At least I was not able to find the end of any filament before that point, and the finest filaments in the band measures only .001 mm. in thickness. Therefore the cylindrical prolongation at the apex of the ovarium .139 mm. in diameter would be thick enough to contain several thousand filaments, as they are here thinner than in the band. The white hyaline filaments originating from the border previously described belong to the hand-shaped dilatation and cannot be connected with the egg tubes, being of a much larger diameter, .008 mm.

The beginning of the egg tubes was empty in the queen of *E. rippertii*, only later they are filled with irregularly placed nuclei; but the apparently younger queen of *T. gilvus* showed the egg tubes filled with such nuclei directly from the beginning of the tubes. Then follow elliptical epithelial cells with nuclei, placed one after the other. The tube of .016 mm. diameter begins to show short transversal compartments, each with three rows of transversally placed egg-cells, followed by somewhat irregular compartments, containing rounded cells each with a germinal vesicle and dot; the cells are placed very nearly together. Then follow quadrangular compartments with a single egg, filled with epithelial cells with nucleoli, and series of elongated cells about ten in number along each side. These compartments become by and by more elongated, with eighteen elongated cells on each side, the contents of the eggs grow darker, and the germinal vesicle smaller. The following eggs are filled with globular cells each containing a strongly reflecting dot, and later suddenly after three or four successive larger ones appear ripe eggs of dark amber color with a less visible germinal vesicle. They are .106 to .113 mm. in length and .076 to .079 mm. in thickness; the germinal vesicle is .033 to .035 mm. in diameter, the germinal dot .006 to .008 mm. in diameter. These eggs have sixteen to eighteen cells along each side, and eight to nine such cells along the smaller sides. The longer sides of the compartments are rounded. The size of the eggs increases till they are ready to be laid. I took several measures of eggs .118 mm. in length and .102 mm. in thickness with a germinal vesicle of .102 mm. in diameter and a germinal dot of .015 mm. in diameter; of riper eggs .307 mm. in length and .256 mm. in thickness; the largest eggs .710 to .769 mm. in length and .318 to .581 mm. in thickness. The disc of the cylinders in which the egg tubes are inserted measures .217 to .256 mm. in diameter, and the central hole, through which the egg has to pass .038 to .051 mm.; therefore this hole has to undergo a remarkably large dilatation, about ten times its diameter to

allow the passage of the largest eggs.

There are nowhere the so-called compartments for nutrition; each egg follows the other, but the ripe ones are connected by darker funiculi, containing epithelial cells, and around them rounded cells with a nucleus. The interior membrane of the egg tubes is structureless and hyaline, not very easily seen. The exterior membrane is fibrous, and around the larger eggs shows often lacunes and holes filled with epithelial cells with nuclei. The connecting parts around the lacunes are often small and of decided muscular appearance. In the part between two eggs the membrane is striated longitudinally.

The chorion of ripe eggs in the tubes shows sexangular spaces, the borders between them comparatively wide and hyaline. The centre of these spaces are darker and filled with pavement cells, round, of .015 mm. in diameter, with numerous fine dark spots.

I was not able to find the micropyle in eggs contained in the ovarium. The micropyle of laid eggs is dorsal a little before the inferior pole; there are ten to twelve little holes somewhat different *in situ*, forming small funnels with a stem as long as the diameter of the holes. Near them numerous filiform spermatozoa (?) were seen. The eggs are cylindrical, concave on one side, the ends rounded a little; often one end thicker; the yolk corpuscula .012 to .025 mm. in thickness.

The dissected queens of *E. rippertii* were from Jamaica and Cuba, of *T. gilvus* from Rangoon, Burmah. *E. rippertii* is probably the long sought for imago of *Termes devastans*, Kollar. The above is a part of a proposed monograph of the anatomy of the *termitina* for which a large number of figures have been made.

## SECOND CONTRIBUTION TO A KNOWLEDGE OF THE AUTUMN LIFE-HISTORY OF CERTAIN LITTLE KNOWN APHIDIDAE.*

BY CLARENCE MOORES WEED, COLUMBUS, OHIO.

The present paper is the result of a continuation of the study of the autumn life-history of the *aphididae*, begun in Illinois in 1887. The observations here recorded were made at Columbus, Ohio, during the autumn of 1888, upon the grounds connected with the Ohio State University.

MELANOXANTHUS SALICTI (HARRIS).

This species was first described by Dr. Harris in his treatise on insects injurious to vegetation as *Aphis salicti*.* In the Flint edition of the Treatise, however, Mr. Uhler states in a foot-note that the specific name had been "long ago appropriated by

* For the first article of this series see *Psyche*, Nov.-Dec., 1888, v. 5, p. 123-134.

* *1st* ed., 1842, p. 190-191; *2nd* ed. 1852, p. 208-209 Flint ed., 1862, p. 239.

Schrank to a very different species of *Aphis* inhabiting Europe," and suggests that the American species "might be called *Aphis salicicola*."

The insect was again briefly discussed as *Lachnus salicicola* by Dr. Cyrus Thomas in 1878,* and finally in his Synopsis of the *aphididae* of Minnesota,† Professor O. W. Oestland refers the species to *Melanoxanthus* and restores the name originally given by Harris, which, he says, "is not occupied when applied to this genus."

The only forms of the species as yet described are the viviparous ones.

My observations upon the insect began in October, 1888, when I found it very abundant on the twigs of a species of willow (*Salix*) growing in the bottoms of the Olentangy river on the Ohio State University farm. The sexed forms were present in great abundance and could be seen mating, while many of the females were busily engaged in oviposition. The following descriptions were drawn up from living specimens.

*Winged male.*

| | |
|---|---|
| Length, tip anterior to tip of folded wings | 7.50 mm. |
| Length of body | 2.50 mm. |
| Wing expanse | 9.00 mm. |

Body small; bluish black, with glaucous bloom. Legs very long, hairy; coxae unicolorous with body; femora and proximas $\frac{1}{2}-\frac{3}{5}$ of tibia reddish brown; apical portion of tibiae together with tarsi, black. Antennae long, hairy, black throughout; joints I and II short, subequal; III, long, $\frac{1}{3}$ longer than IV, which is also about $\frac{1}{3}$ longer than V; VII slightly longer than VI; joints III to VII roughened with numerous sensoria; cornicles vasiform. Prothorax with a blunt tubercle on each side. Wings hyaline; veins brownish; wing insertions generally greenish black.

Described from numerous specimens taken on twigs *Salix* sp., 29 October 1888. Some of them seen *in copula* with oviparous females.

*Oviparous female.*

| | |
|---|---|
| Length of body | 3.00 mm. |
| Width of body across abdomen | 1.50 mm. |

Body bluish black, with a glaucous bloom. Legs hairy; coxae unicolorous with body; femora and proxima $\frac{1}{2}$-$\frac{2}{3}$ tibiae yellowish brown, and apical portion of tibiae together with tarsi black. Antennae hairy; joints I and II unicolorous with body, proxima $\frac{2}{3}$–$\frac{3}{4}$ of III yellowish brown, and the remainder black: joints I and II short, subequal; III longest of any but shorter than IV + V; IV slightly longer than V; VI and VII subequal: V, VI, and VII roughened with numerous sensoria. Prothorax with a blunt tubercle on each side. Cornicles short, vasiform, flanged at tip; orange yellow. Rostrum blackish, reaching anterior margin posterior coxae.

Described from many specimens collected on twigs of *Salix* sp., 29 October 1888.

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* *8th* rept. State ent. Ill., p. 115-116.

† Geol. and nat. hist surv. of Minn., Bull. No. 4, p. 36.

*Egg.*

Length 1.00 mm., oval, greenish at first but becoming black in a short time. Deposited on bark of twigs, especially about buds.

### MYZUS RIBIS (LINN.).

Notwithstanding the abundance and destructiveness of this species, its life-history does not seem to have been traced, nor the sexed forms described.

During the past season I observed the habits of the species which was abundant on the currant bushes in my garden, finding that the lice left the bushes early in summer but was unable to learn to what plant they migrated. In September winged viviparous females returned to the currants and gave birth to young which developed into oviparous females. The winged males flew in from some other plants, presumably being developed on the same plant as the migrating viviparous females which gave birth to the oviparous form.

*Winged male.*

| | |
|---|---|
| Length of body . . . | 2.00 mm. |
| " " antennae . . | 2.70 mm. |
| " " cornicles . . | 0.50 mm. |
| Wing expanse . . . . | 8.50 mm. |

Antennae, head, band on dorsum of prothorax, row of dots on each side of dorsum of abdomen, and transverse patch back of middle of same, black. Legs very long, with coxae, apical half of femora, and apical fourth of tibiae, together with tarsi, black, the rest being yellow. Cornicles long, slender, slightly incrassate. Antennae about ⅓ longer than body, slender, roughened with numerous sensoria; joint I large, thickened, about as long as II; III longer than any except VII; IV and V subequal; VI shorter than V; VII very long and slender. Cauda minutely tuberculate, with several curved stiff hairs arising from the margin.

Described from several specimens taken on under surface of cultivated currant leaves, 31 October, 1888.

*Oviparous female.*

Length . . . .75 mm. to 1.00 mm.

Body globose; greenish, shade varying with age of specimen. Antennae pale at base but blackish apically, and at articulations. Legs pale, articulations and tarsi dusky; the thickened posterior tibiae greenish brown. Antennae short, less than half the length of the body: 6-jointed; joints I and II short, subequal; III and VI subequal, both longer than any of others; IV and V subequal, each about ⅓ shorter than III; joints III to VI strongly tuberculate, having numerous sensoria. Cauda long and large, spinosely tuberculate, with several long curved hairs arising from its dorsal surface. Rostrum reaching posterior margin of second coxae.

Described from many specimens taken on under surface of leaves of cultivated currant, 31 October, 1888.

In some specimens two large eggs were plainly visible. I did not find the eggs *in situ* but there is little doubt that they are deposited on the twigs, especially about the buds.

# NORTH AMERICAN TYPHLOCYBINI.

BY CHARLES WILLIAM WOODWORTH, FAYETTEVILLE, ARK.

Although the prettiest and daintiest of the whole family, the group *typhlocybini* is the least known to entomologists, at least in this country In order to call the attention of collectors to them I will attempt to straighten out the generic groups into which they are arranged and review what is known about our native species.

The insects composing this group were included by Linnaeus, Fabricius and Zetterstedt in the old genus *Cicada* and by Germar, Herrich-Schaffer and Say in *Tettigonia*. In 1832 Curtis (Ent. mag. v. 1) made for these insects a new genus for which he proposed the name *Eupteryx* and cited *C. pictae* Fabr. as the type. He did not have correct views as to the limitation of the genus he established for we find him in his later works including in it some insects belonging to the genus *Cicadula*. The next year, 1883, Germar (Silb. Rev. Ent. v. 1.) applied the name *Typhlocyba* to the same insects and his name has been generally adopted by entomologists although the English hemipterologists have stoutly contested for the priority of *Eupteryx*. In proposing the name Germar simply mentions the following species as forming the genus: "*Cicada aurata*, *urticae vittata*, *picta*, *quercus*, Fabr., etc." Now it is evident that one of these species must be taken as the type of the genus and as all except *quercus* belong to *Eupteryx* in its most restricted sense this species is the type. The name *Typhlocyba* has been used as far as I can make out only for insects of the groupy *typhlocybini* possibly Fitch and Walsh may have included a few species of *Gnathodes* and *Cicadula*.

In 1840 Zetterstedt (Insecta Lapponica) included the species of this group in his genus *Cicadula*, but as I have already shown (Psyche, v. 5, p. 75) the genus *Cicadula* as first and naturally restricted excludes these forms. In 1850 Hardy (Trans. Tyneside nat. field club, p. 423) published a new British genus *Dicraneura* which seems to have been for a long time unnoticed, partly perhaps on account of its obscure place of publication and partly on account of the indisposition of European entomologists to dismember the old genus *Typhlocyba*. The next year Fitch (Rep. on state cab. Nat. Hist. N. Y. 1851, p. 62-64) ignoring or overlooking the genera already proposed made two new genera *Erythroneura* and *Empoa* for our North American species. These he separated by the possession of a quadrate cell in the apex of the elytron in the first and a triangular one in the second genus, but this character is not of generic, or even of specific value as can be proven by examining a large series of specimens of any species. I have even seen the

two forms of venation on the two sides of the same insect. All the species mentioned or described by Fitch belong to *Typhlocyba* except *fabae* of Harris. The latter was only incidentally mentioned by him as belonging to *Erythroneura* so I think it is the proper course to consider both his genera as synonyms of *Typhlocyba*. Fitch was soon aware that his genera covered the same ground as the European genus *Typhlocyba*, and five years afterward in his annual report for 1856, published the same year, he attempts to restrict the genus *Typhlocyba* to a group of insects unknown to Germar. In this he has been followed by no one but Walsh and it is an unwarranted restriction. Walsh in this same year published in the Prairie farmer and also separately (reprinted in Proc. Boston, soc. nat. hist. v. 9, p. 314-318) an article in which he makes two more genera *Chloroneura* and *Empoasca* parallel with those of Fitch and separated by the same character. They form a single genus distinct from any yet described which we will call by the shorter and euphonious name *Empoasca*.

In his "Neue gattungen" Fieber (Verh. zool.-bot gesell. in Wien 16, p. 506-509) made ten genera of the European species indicating types as follows:

*Compsus elegantula* H-S.
*discicollis* H-S.
*albostriellis* H-S.
*Erythria areolata* Fall.
*Notus flavipennis* Zett.
*furcipatus* Flor.
*orichalceus* Dahlb.
*Chloria viridula* Fall.
*pura* Stal.
*Kybos smaragdulus* Fall.
*commisurallis* Stal.
*Anomia quercus* L.
*Zyginia nivea* Muls.
*Idia scutellaris* H-S.
*pullula* Boh.
*Typhlocyba lineatella* Fall.
*Eupteryx vittata* L.
*urticae* Fabr.

He made the same error that Walsh and Fitch had in dividing the group on insufficient characters so that some of his genera had to be abandoned and two of the names (*Compsus* and *Chloria*) were preoccupied. These latter were changed by him in his "Katalog der Europaischer Cicadinen" [1872] to *Alebra* and *Chlorita*. In this same work he unites *Erythria* with *Notus* and *Idia* with *Zyginia*. The year previous Sahlburg [Cicadaria 1871] had united *Zyginia*, *Anomia* and *Idia* with *Typhlocyba* and also *Chloria* with *Kybos*. The last two he called erroneously *Cicadula*. In 1875 Douglass (Ent. mo. mag. v. 12) substituted the older name *Dicraneura* for *Notus* and now after putting in our North American genera the synonymy stands as follows:

*Alebra* Fieber
*Compsus* Fieber
*Empoasca* Walsh
*Chloroneura* Walsh
*Kybos* Fieber
*Chlorita* Fieber
*Chloria* Fieber

*Dicraneura* Hardy
*Notus* Fieber
*Erythia* Fieber
*Typhlocyba* Germar
*Erythroneura* Fitch
*Empoa* Fitch
*Idia* Fieber
*Anomia* Fieber
*Zyginia* Fieber
*Eupteryx* Curtis.

These genera may be very readily distinguished by the following synopsis:

A marginal vein extending all around the posterior wing parallel with the margin.

Elytra margined posteriorly. *Alebra*.

Elytra not margined.

Two apical cells in the posterior wing. *Dicraneura*.

One apical cell in the posterior wing. *Empoasca*.

No marginal vein at the tip of the posterior wing so that here the veins end in the margin.

The first two longitudinal veins uniting before reaching the margin. *Typhlocyba*.

All four veins attain the margin. *Eupteryx*.

North American species have been described as follows: by Say (Proc. acad. nat. sci. Phila., v. 4, 1825; Compl. works, v. 2, p. 259) four species; Harris (Encyclopaedia Americana 1831 and Injurious insects 1841) three species. Fitch (Rep. on state cab. nat. hist., N. Y., 1851) and (Third report on the noxious and other insects of the state of New York 1856) eight species; Stal (Stett. ent. zeit. v. 19, p. 195–196) three species Walsh as cited above thirteen species. Uhler (Bull. U. S. geol. surv. v. 3, 1877) one species and Forbes (13th rep. Ill. state entomologist 1884) one.

To *Alebra* belongs *aurea*, *pallida* and *binotata* of Walsh but the descriptions are so meagre that no one can certainly say that they are distinct. I know quite a number of very pretty forms of this genus still undescribed.

Of the described forms of the genus *Empoasca* we may make four groups of what may be but four species. The first includes *fabae* of Harris, *viridescens consobrina* and *malefica* of Walsh and *pura* of Stal which are uniform green without markings. Second *obtusa* and *maligna* of Walsh which are certainly not distinct from each other but differ from the first in having a much more obtuse vertex. Third *albopicta* of Forbes which is distinguished by the white markings on the vertex. And fourth the brilliant *aureaviridis* of Uhler.

*Dicraneura* is represented by *abnormis* of Walsh and *carinata* of Stal which may not be different.

In the genus *Typhlocyba* we have one of the most variable species in existence as regards the coloring, the so-called grape thrips *Typhlocyba vitis* of Harris. Just how many of the forms described as distinct species of this genus will be found to be varieties, of course it is impossible at present to say, but certainly half of the colored species so far described have been definitely made out to be varieties. The colored species are *vitis* of Harris *basilaris*, *comes*, *obliqua*, and *trifasciata* of Say, *vulnerata*, *tricincta*, *coccinia*, *vitifex* and *affinis*

of Fitch and *ziczac* and *octonotata* of Walsh. The unicolorous species are *querci* Fitch *commissuralis* Stal and *australis* and *albicans* of Walsh. *Rosae* Harris, I think, belongs here.

There are no described species of *Eupteryx* in North America but I am acquainted with several undescribed.

One would expect that several American species would be the same as European but although I have compared our species with the descriptions of the European insects and have had a considerable set of European *typhlocybini* for comparison I have yet to find one identical.

This family is certainly a promising one for study as the literature is small and, therefore, easily obtained and a rich harvest of new species is waiting to reward the student.

# NOTES ON CERTAIN CYNIPIDAE WITH DESCRIPTIONS OF NEW SPECIES.

BY C. P. GILLETTE, AMES, IOWA.

(*Concluded from p. 188.*)

## NEW SPECIES DESCRIBED.

### GALLS ON WHITE OAK (*Quercus alba*).

*Andricus foliaformis*, n. sp.

Gall. Small wart-like projections thrown out from the mid-rib on the under side of the leaves from which there grows a leafy expanse that extends on all sides like the corolla of a rotate flower. (Fig. 1.)

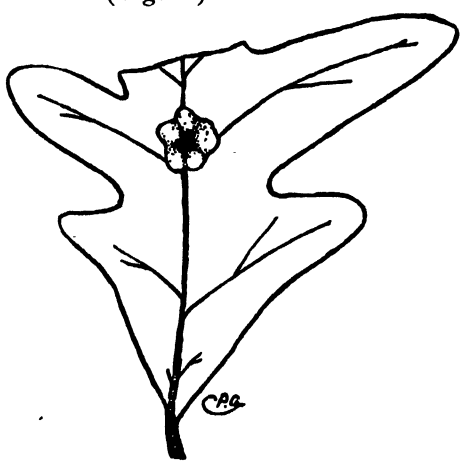


Fig. 1.

Gall-fly: Female. Head, dark reddish brown with median line of face, vertex, and occiput almost black; front and genae with many short gray hairs; vertex bare. Thorax from collar two-thirds of the way to the scutellum, between the parapsidal grooves, black; the remainder of the thorax brown. Parapsidal grooves distinct but not deep; outside of the grooves on either side a longitudinal patch of black is separated from the central black portion by a yellowish-brown line along either groove. Dorsal portion of thorax sparsely haired; pleurae rather densely haired; tegulae brown. Abdomen brown, smooth and shining, the darkest portion being on the posterior dorsal part. With a power of 50 diameters, minute punctures can be seen on the abdominal segments; second segment sparsely haired on sides. Scutellum with two fovae at base separated from each other by a narrow ridge; rounded behind, black at base, changing to

brown at the tip, and thinly set with long hairs. Head, thorax and abdomen, when examined with a power of 50 diameters, have a scaled appearance. Antennae three-fourths the length of the body, 13-jointed, first and second joints stout, third joint longest, last joint nearly equal to the two preceding in length; slightly clavate and rather densely ciliated throughout; basal joints, yellowish-brown. Length of body, 1.5 mm.

Described from a single specimen that issued 30 July.

*Biorhiza rubinus*, n. sp.

Galls: When the leaves begin to turn in October, subglobular juicy galls about two or three mm. in diameter and rosy in color are found attached to the under side of the leaves. From a number of these galls collected in October, '87, four were selected and opened 15 October '88, from which one fully developed female cynip and three plump white larvae were obtained.

Gall-fly: Shining black in color except the joints of the legs which are yellowish-brown. Head and thorax appear to be covered with shiny black scales. Clypeus with a number of rather stout hairs; a very few short hairs on front border of epicranium and on occiput; vertex bare. Antennae 13-jointed reaching the middle of the abdomen, first and second joints nearly equal in length and rather stout, the first somewhat stouter than the second, third joint longest and most slender, third to 12th gradually shortened, 13th once and a half as long as the 12th; brown-black in color and covered with a short gray pubescence. Parapsidal grooves are shallow and indistinct, but can be traced about one-third of the way from the scutellum to the collar. Scutellum much rounded behind and with two shallow fovae at base. Abdomen a smooth glossy black. Legs rather thinly set with a gray pubescence; femora with the same scaled appearance as the head and thorax; thorax sparsely set with short gray hairs. Length 1.5 mm.

SWAMP OAK (*Quercus bicolor*).

*Holcaspis bassetti*, n. sp.

Gall: The gall occurs, sometimes singly, but usually in clusters about the twigs. The cluster represented at Fig 2

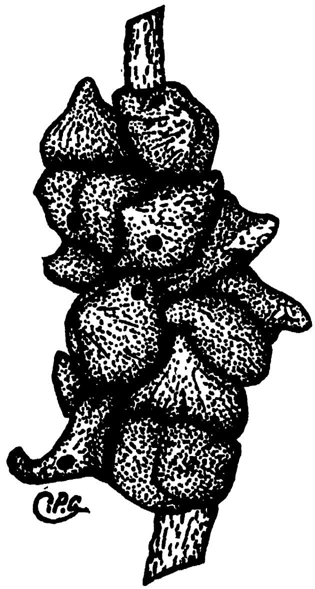


Fig. 2.

was composed of 30 of these galls closely

crowded together. The galls resemble very much the galls of *Holcaspis duricoria* Bass. (*Cynips mamma* Wal.) (Fig. 3). The galls are very much the

Fig. 3.

shape that a thick waxy material would take if dropped on the twigs and then suddenly congealed, leaving stout, teat-like projections standing out from each drop. The central cell is placed low in the gall and can usually be seen protruding when the latter is broken off. Some entomologists have thought this gall to be identical with Walsh's *C. mamma*, but I have examined a large number of both forms and the following points of difference, which convince me that this, if not not a new species, is certainly a well marked variety:

*H. bassetti* as compared with *H. duricoria*, is rather larger and is more irregular in outline. The teat-like projection is much heavier and longer in proportion to the size of the gall and appears to be a drawn-out portion of the substance of the gall, while in *duricoria* it is a small, hard pointed projection much resembling a spine in many cases, and often almost entirely wanting. In *bassetti* the substance of the gall is more corky and easy to cut. The central cell, as before stated, is at the base of the gall, and when the latter is removed the point of the cell can usually be seen protruding below. Before the gall is detached the central cell is situated with its greatest diameter perpendicular to the limb at the point of attachment of the gall. In *duricoria* the cell is situated at the centre of the gall; it never protrudes from below when the gall is detached; and it always has its greatest diameter parallel with the limb at the point of attachment of the gall. The central or larval cells are also differently shaped. In *duricoria* the cell is egg-shaped, while in *bassetti* the end towards the twig is somewhat pointed, so that the cell is very much the shape of a plump apple seed with the point rounded off.

Gall-fly: Female. Median line of the face black, the black portion being broadest between the eyes; vertex dark brown to black; occiput black; orbits and genae cinnamon brown; clypeus and lower border of epicranium black; mandibles black at base and tip, with the median portion brown; palpi a light amber color, with the terminal joints of the maxillary palpi infuscate; and all joints set with gray hairs. The epicra-

nium joining the clypeus is finely rugose. Antennæ 13-jointed; third joint the longest; joints from 3-12 gradually shorter; the 13th equal to the two preceding in length. The terminal joints, under a power of 50 diameters, appear distinctly fluted longitudinally. Color of the antennae black, except the first two joints which are brown-black. All the joints are rather thickly set with a fine pubescense. Parapsidal grooves begin midway on the thorax and extend back to the scutellum. They are very shallow and to the unaided eye appear like two narrow black lines. A little forward of the grooves two parallel black lines arise and extend forward to the collar. Near the base of the wings on either side there begins another black line that runs to the scutellum. In the two latter cases the black lines are narrow, strips of the thorax that have no hairs growing upon them. Scutellum without fovae or grooves, rounded and elevated posteriorly, covered with a yellowish brown pubescense, very irregularly rugose and black in color, except the tip, which is usually brown. Tegulae brown. Abdomen shining black with silky pubescense on the sides of the second segment. Under a power of fifty diameters the sides of the abdominal segments appear crackled or scaled and finely punctate. Wings hyaline; cross veins black and heavy; radial nervure not reaching the costal margin. Length of wing 5.2 to 5.7 mm. Legs very dark cinnamon brown and rather thickly set with a gray pubescense. Terminal joints of tarsi black. Length 4.2 mm.

Described from nine specimens reared from the galls.

*Cynips nigricens* n. sp.

Galls in clusters attached to the midrib on the under side of the leaves. The galls are cone-shaped, and resemble very small galls of *C. strobilana*. The galls fall to the ground a little before the leaves drop in the fall. From a large number of these galls gathered in October, 1887, I obtained one perfectly developed female late in September, 1888. The fly may be described as follows:

Color, except joints of legs, tarsi, and venter, black.

All parts of the insect except the dorsal portion of the first two or three abdominal segments, and compound eyes, are rather densely and evenly covered with a short gray pubescence set in minute punctures.

Head: vertex and occiput appear to be covered with minute thick scales; clypeus and front rather coarsely punctate. Antennae 13-jointed; first joint stout, third joint longest, third to seventh gradually shorter, eighth to twelfth subequal, thirteenth as long as the two preceding and with a slight indication of a division at its middle. The last five or six joints form a slight club and are fluted longitudinally. Length 2 mm. Thorax: parapsidal grooves distinct but narrow; widely separated at collar, and forming a double curve as they pass over the thorax to the scutellum. Two black parallel lines begin midway on the thorax between the parapsides and

extend to the collar. Another slightly depressed line begins on either side of the thorax near the base of the wings and runs towards the scutellum. Thorax and scutellum with the same scaled appearance as the epicranium. Scutellum broad as long, obtusely rounded posteriorly and with two shallow fovae at base. Wings: areolet small and indistinct; cubital nervure rather faint; cross veins rather heavy; radial nervure not reaching the costal margin. Length, 2 mm. Abdomen: the large second segment occupies about one-third of the abdomen; all of the segments punctured and set with many short gray hairs. Length of insect 3 mm.

BURR OAK (*Quercus macrocarpa*).
*Acraspis villosus* n. sp.

Gall: Hard globular excrescenses on the under side of the leaves and always attached to the midrib. (Fig. 4) Medium sized specimens measure 5-16 of an inch in diameter. The galls resemble rather closely the galls of *A. erinaceae* but differ from it by having a much heavier pubescense, by always being single-celled and by being light yellow in color.

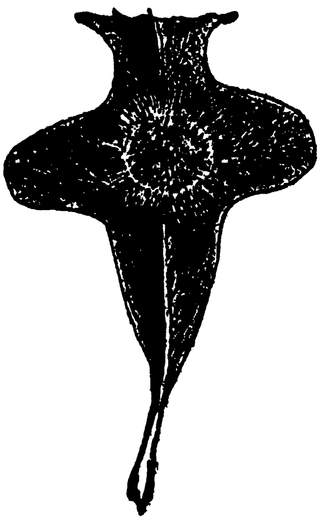

Fig. 4.

Gall-fly: Sub apterous females only have been reared.

Head: Median line of face, including clypeus, vertex and occiput, black. Orbits and genae dark cinnamon brown. In dark specimens nearly the entire face is black. Jaws and terminal joints of palpi black. Head and mouth parts sparsely pubescent. Epicranium, bordering clypeus, rugose; remainder of head punctate. Thorax, brown, bordered anteriorly and posteriorly with black. Parapsidal grooves wanting. Thorax and scutellum punctate and finely pubescent. Abdomen thickly set with a yellowish-gray pubescence that gives a decided velvety lustre to the sides of the abdomen. The anterior dorsal portion of the second segment has a large bare spot that is continued in a narrow line back over the succeeding segments. The borders of the segments show as black rings crossing the velvety surface. Legs, brown; tarsi infuscate. Antennae 13-jointed; third joint longest; last joint as long as the two preceding, and all of the joints rather densely haired. Length, 4 mm.

*Neuroterus nigrum* n. sp.

Galls: The galls are little pimples about 2 mm. in diameter on the surface of the leaves (Fig. 5) and show equally well from above and below. There are

usually a large number on a single leaf. The galls appear late in August but the flies do not emerge until the following summer. Few of these galls were noticed in Michigan, but they are very common about Ames, Iowa. My specimens were reared from the leaves of the burr oak, but in a number of instances I have taken galls that seem exactly similar on the leaves of the white oak, *Q. alba*.

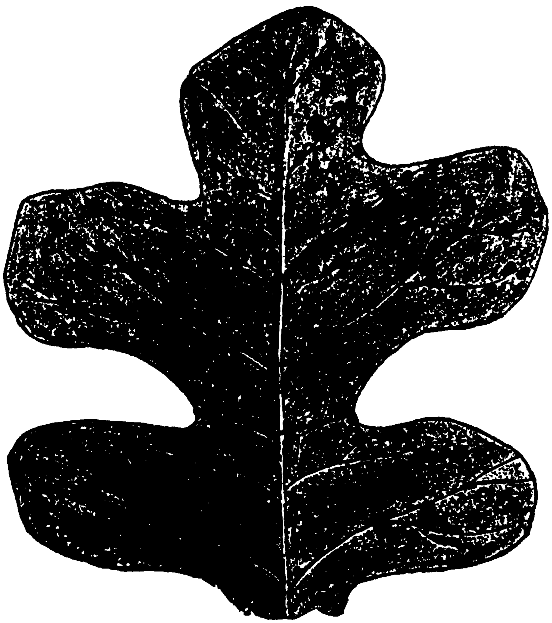

Fig. 5.

Gall-fly: Color, except the tarsi, joints of the legs and antennae, black. Head and thorax shining and with a scaled appearance when viewed with a high power. Thorax almost entirely free from hairs and without parapsidal grooves. The meso-thorax is notched posteriorly making it appear as if the scutellum was unifoveate. Scutellum broadly rounded behind; without fovae or grooves; with a very few hairs; and with the same scaly appearance as the head and the thorax. Abdomen, shining black in color, with the ovipositor sheathes projecting. Antennae with the first and second joints very stout and sub-equal in length; third joint longest, and the last four or five joints forming a slight club. The basal joints are sparsely and the terminal joints rather thickly set with short hairs; number of joints, 13. Eyes coarse; ocelli rather obscure. Wings, hyaline; areolet large; radial nervure reaching the costal margin; marginal cell open. Length, 1.3 mm. Length of body, 1 mm.

RED OAK (*Quercus rubra*).

*Amphibolips cookii* n. sp.

Galls (Fig. 6) globular, with a central larval cell held in place by stout radiating fibers. When green, the galls resemble very much the growing galls of *Amphibolips inanis* O. S. The gall differs from that of *A. inanis* by having a thicker outer shell, by having much stouter radiating fibres, by being somewhat drawn out into a point at either extremity, and by occurring on the buds instead of the leaves. The galls fall with the leaves or before them, and, when dried, the outer surface is much shrivelled in appearance. About a pint of these galls were gathered, some late in the fall and others early in the spring, under a large red oak. On cutting into these galls the first day of September following, five fully developed flies and one pupa were found, all females.

Fig. 6.

Gall-fly: Head small; clypeus and jaws punctate; vertex, occiput, and median line of front coarsely pitted or sculptured; genae and sides of the face deeply rugose, the furrows spreading out like a fan from either side of the clypeus; entire head jet black and rather thinly set with a grayish pubescence, except on the vertex, where it is bare. Jaws black; palpi brown. Antennæ reach the middle of the abdomen; 13-jointed, third joint longest; joints 3-12 gradually shorter; 13th joint next to the third in length and as long as the 11th and 12th together. Thorax entirely black. Parapsidal grooves present but very indistinct and can be traced about one-third of the way from the scutellum to the collar. Between and a little in front of these grooves arise two parallel black ridges that appear as minute shiny lines which extend forward to the collar. Two other similar lines start midway on the thorax a little outside of the parapsidal grooves near the base of the wings and extend back to the scutellum. Thorax and scutellum deeply sculptured and sparsely set with short gray hairs. Scutellum with two large fovae at the base separated by a narrow septum; subquadrangular in outline and rounded and elevated posteriorly. Abdomen varies from a very dark amber to almost black; segments densely and finely punctate when examined with a power of 20 diameters; lateral portions of second segment very sparsely pubescent. Legs dark amber in color except the tips of the tarsi which are black; finely pubescent throughout; coxae black. Wings seven to eight mm. in length; somewhat smoky, and with a large stigmal spot at the base of the marginal cell. Length of body five and one half mm.

The following is a list of the cynipidous galls taken in the vicinity of the Michigan agricultural college. I have in each case given the variety of oak upon which they were taken, the date that the flies emerged, when reared, and the guests and parasites reared from the different species:

| Name of gall-fly. | Taken from | Gall taken. | Fly emerged. | Guests. | Parasites. |
|---|---|---|---|---|---|
| Diastrophus radicum Bass. | Raspberry roots. | May | May 24. | | |
| Amphibolips coccinea O. S. | Q. coccinea leaves | June 14. | June 16. | | |
| Amphibolips cookii n. sp. | Q. rubra buds. | Nov. 10, '87 | Sept. 1, '88. | | An undetermined species. |
| Amphibolips inanis O. S. | Q. rubra leaves | June 16. | June 21. | | Torymus sp.<br>Tetrastichus sp. |
| Amphibolips nubilipennis H. | Q. rubra leaves | June 20. | June 25. | | An undetermined species. |
| Amphibolips prunus Walsh. | Q. nigrum | Aug. 17 | | | |
| Amphibolips sculpta Bass. | Q. rubra leaves | June 18. | June 20. | | Syntomaspis sp. |
| Amphibolips spongifica O. S. | Q. rubra leaves | July | Oct. 3 | | An undetermined species |
| Callirhytis clavula Bass | Q. alba twigs | March | | Ceroptes petiolicola O. S. | |
| Callirhytis cornigera O. S. | Q. ruba twigs. | Nov. | | | |
| Callirhytis futilis O. S. | Q. alba leaves. | Dec. | | | |
| Callirhytis punctatus Bass | Q. rubra limbs | April | | Synergus lignicola O. S.<br>Ceroptes petiolicola O. S. | Decatoma varians Walsh. |
| Callirhytis scitulus Bass. | Q. rubra twigs | Nov. | | | An undetermined species. |
| Callirhytis seminator Harr. | Q. alba limbs. | July 5 | July 7 | | Syntomaspis sp. |
| Andricus foliaformis n. sp. | Q. alba leaves | July 29 | July 30. | | |
| Andricus flocci Bass | Q. alba and Q. microcarpa leaves | Dec. | March 5 | | Tetrastychus sp.<br>Eurytoma sp. |
| Andricus futilis O. S. | Q. alba leaves | Dec. | | | |
| Andricus petiolicola Bass. | Q. bicolor and Q. macrocarpa leaves | July 3 | July 5 | Ceroptes petiolicola O. S. | An undetermined species. |
| Andricus singularis Bass | Q. rubra leaves | June 5 | June 8 | | An undetermined species. |
| Cynips dimorphus Ash | Q. prinus leaves<br>Q. bicolor "<br>Q. macrocarpa leaves. | Sept. 24 | | | An undetermined species. |
| Cynips nigricens n. sp. | Q. bicolor leaves | Oct. 10, '87. | Sept. 25, '88 | | An undetermined species. |
| Cynips strobilana O. S. | Q. bicolor and Q. macrocarpa twigs | March | | Synergus lignicola O. S. | Eurytoma sp. |
| Acraspis erinaceae Walsh. | Q. alba leaves. | Oct. 20 | Nov. 5 | | Decatoma flavus. |
| Acraspis villosus n. sp. | Q. macrocarpa leaves | Oct. 20 | Oct. 29. | | Eurytoma sp. |
| Biorhiza forticornis Walsh. | Q. alba twigs | Sept. | | | An undetermined species. |
| Biorhiza rubinus n. sp. | Q. alba leaves. | Oct. 12, '87. | Oct. 15, '88. | | |
| Biorhiza macrocarpae Bass | Q. macrocarpa leaves | Oct. 1 | Oct. 10. | | |
| Holcaspis globulus Fitch | Q. alba twigs. | Oct. 15. | Oct. 29. | | Decatoma varians Walsh.<br>Decatoma sp.<br>Eurytoma sp. |
| Holcaspis duricoria Bass. | Q. macrocarpa and Q. bicolor twigs | Oct. 18. | Oct. 23. | | Orymus ventricosus.<br>Decatoma varians Walsh. |
| Holcaspis bassetti n. sp | Q. bicolor twigs | Oct. 18. | Oct. 31. | | Orymus ventricosus.<br>Orymus sp.<br>Decatoma varians Walsh. |
| Holcaspis rugosa Bass | Q. prinus twigs | Oct. 15. | Oct. 20. | | Eurytoma punctiventris Walsh. |
| Dryophanta papula Bass. | Q. rubra leaves and Q. coccinea leaves | July 8. | July 12. | | An undetermined species. |
| Neuroterus nigrum n. sp. | Q. macrocarpa leaves. | Oct. 20, '87. | May 10, '88. | | An undetermined species. |
| Neuroterus noxiosus Bass | Q. bicolor twigs | Jan. 3 | March 24. | Ceroptes petiolicola O. S.<br>Synergus sp. | Ceroptes sp.<br>Orymus minutus. |
| Neuroterus vesicula Bass | Q. bicolor and Q. macrocarpa buds | April 29 | May 3 | | |

# NOTES ON THE EPIPHARYNX, AND THE EPIPHARYNGEAL ORGANS OF TASTE IN MANDIBULATE INSECTS.

BY ALPHEUS SPRING PACKARD, PROVIDENCE, R. I.

(Concluded from p. 199.)

## Order *Platyptera*.

*Pteronarcys pupa*.—In a specimen from Pagosa, San Juan River, Colorado, the surface of the labrum is provided with stout curved setae which are often forked at the end, like those occurring on the joints of the antennae and caudal stylets. The epipharynx is densely pilose on the edge and over the surface, but there are no sense-cups or rods.

*Perla* sp.—In a specimen from the Glen, N. H., the labrum is broad and very short, full and rounded, and there is no trace of a median furrow. The epipharynx has a narrow, curved, long, transverse area parallel to and situated near the front edge, on which are two opposing sets of broad-based "gathering" or "hooked" hairs; elsewhere the surface is covered with fine tactile setae, which arise from a cup-shaped base. There is a median furrow free from these setae, and I cannot detect any genuine taste-cups.

In another species from Montana there is the same structure of the epipharynx, which bears at the end a number of tactile setae arising from a cup-shaped base, but there are no true taste-cups.

*Psocus novae-scotiae* Walk. — Labrum rather large and broad, and somewhat excavated on the front edge. The epipharynx in front is divided into lobes, the front edge of the middle one of which extends a little farther out than the lateral lobes, and has a straight edge. This lobe bears two rows of short setae, those of the distal or marginal row being shorter and consisting of five or six stouter setae, which are blunt at the tip and have the appearance of having been worn off. On the basal half in the middle is a large polygonal pilose area. I cannot detect any sense-cups.

*Psocus* sp.—In a species from Florida the labrum and epipharynx, with the armature of the latter, are as in the preceding species, and there are no sense-cups to be seen. They seem to be wanting in this genus.

*Eutermes ripperti*.— In a larval and a winged female from Nassau the labrum and epipharynx have the same shape and armature. The end of the labrum is full and round, with no trace of a median suture. The epipharynx is pilose, with a few long tactile setae. On the front edge is a transverse row of six gustatory (?) setae, each bristle being acute and arising from a beaker-like base. Along each side of the median line on the anterior half of the epipharynx is a group of about 20 scattered

peculiar long depressed tubules ending in a circular membrane, out of which a very short hair projects. These appear to be gustatory. There are also two curved rows of minute cells with a nucleus, three deep, which extend on each side from under the front edge of the clypeus and end near the front edge of the labrum, the two rows converging in front; they are very singular in shape, and towards the front the cells become much elongated and arranged in four or five close ranks. These are probably not sensory cups, but modified surface setae.

*Termopsis angusticollis* Hagen.—In a female from the Pacific Coast I cannot detect any taste-cups and any organs that appear to be gustatory. The surface of the epipharynx is simply pilose.

## Order *Odonata*.

*Calopteryx* sp.— In a specimen from Florida the armature of the epipharynx is much as in *Diplax*, and there are 25 taste-cups on each side of the median line, but extending farther in front than in *Diplax*.

*Diplax* sp. — In this as the other dragon flies examined, the labrum is full on the front edge, but there is a fine median suture extending back nearly half way to the base meeting a wide triangular or V-shaped gap. On the anterior edge of the epipharynx is a row of long stiff tactile setae; there is a lateral group of tactile bristles pointing inwards and another smaller group of similar setae in the middle on each side of the median suture, while a few minute hairs extend to the suture.

There is a group of about 14 taste-cups at the base of the labrum on each side of the median line; the central bristle cannot be seen, but as the nucleus is well defined when looked at vertically there is probably one present in each taste-cup. On the outside of each gustatory field are a few inwardly-directed defensive setae. Also outside of each group of taste-cups are near the base of the labrum a group of singular parallel sabre-shaped setae, pointing inwardly and likewise directed towards the base of the labrum.

*Aeschna heros* Fabr.— Epipharnyx armed with small, short, slender bristles, which along the base (*i.e.*, under the base of the labrum) on each side of the median line become very stout and short. In front of this group of short setae is a pair of short-handled brushes consisting of stiff, coarse setae, one on each side of the median line. In the middle, but situated rather far apart, are two roundish pilose areas. There are two groups of about 25 to 30 taste-cups, like those of *Calopteryx* and *Diplax*, being without a distinct hair and situated as in those genera.

## Order *Neuroptera*.

*Sialis infumata* Newm.—Along the median line of the epipharynx and near the front are about twenty scattered gustatory pegs, which are minute, but longer and more acute than usual. The other setae are large, long and scattered over both sides of the organ.

*Chauliodes maculatus* Ramb.— The entire surface of the epipharynx is covered with very fine hairs which are broad at the base and very short. There are one or two taste-cups under the front edge of the clypeus; others are scattered along the middle from the base of the labrum to the front, but are not arranged in definite order.

*Corydalis cornutus* Linn. — The epipharynx of the female is covered with scattered tactile setae, and there are no sense-cups, pits, or rods to be seen.

*Chrysopa* sp.—In a specimen from Florida the labrum is deeply notched at the end. Over the epipharynx are scattered cups with a short acute bristle, which are probably gustatory in function, though they are not confined to the median region of the epipharynx.

*Myrmeleon diversum* Hagen.—Labrum very short, with a slight shallow median excavation. As in *Chrysopa*, the presence in the epipharynx of sense-pits or taste-cups is doubtful. What at first seem scattered taste-cups, mostly bear long tactile hairs, which in some cases are very fine and short. But there is a group of pits, probably gustatory, about twelve on each side of the anterior clypeal region, from one to three of them being situated on the base of the labral region; there are also a few on each side near the base of the labral region, some of those in the triangular area near the front edge of the epipharynx may also be gustatory in function. On the whole I am disposed to regard these structures as taste-cups.

*Mantispa brunnea* Say.—In a specimen from Utah the labrum is rather long and pointed in front, with no traces of a median suture. On the side of the epipharynx are tactile hairs, but along the middle from the base to near the front edge are scattered about 30 unmistakable taste-cups, each bearing a short, fine hair. This confirms me in the belief that the structures above described in *Chrysopa* and in *Myrmeleon* are also gustatory.

### Order *Coleoptera*.

I have been unable to detect any sense-organs in the epipharynx of *Dendroctonus rufipennis* Kirby, or of *Lucanus dama* Thunb; on the other hand, taste-cups occur in the larva of cerambycid, scarabaeid and other beetles; but I have been unable to discover any taste-organs in the larva of a rather large elaterid from Florida. Moreover, taste-cups appear to be about as well developed in the carnivorous beetles *Carabidae* as in the phytophagous or lignivorous groups.

*Epicauta maculata* Say. — Labrum hollowed in front. Epipharynx with unusually numerous taste-cups, which are conical papilliform, and truncated at the end as if open, the edge of the opening is ragged, but no distinct bristle is present, except in a few. Over 100 taste-cups were counted in the middle and near the front; around the edge of the sinus is a regular marginal row of large, longer, more distinctly chitinized taste-cups, whose walls are streaked up and down by chitinous thickenings. It will be seen that in number, structure

and arrangement these organs present excellent and distinctive specific characters.

*Epicauta callosa* Lec. — In a specimen from Montana, the labrum is notched and on the epipharynx over the region around the bottom of the notch, and from these to the base of the labrum are scattered about 55 taste-cups; and also on either side of a median setose ridge which passes back under the clypeal region are about 10 cells, which may be taste-cups.

*Nemognatha lurida* Lec. — In a female from Montana a large triangular area extending to and widening out on the front edge of the epipharynx contains about 80 remarkably small taste-cups, not more than $\frac{1}{4}$ to $\frac{1}{6}$ as large as those on the maxillae of the same beetle. Unless these are gustatory it is difficult to account for their presence here and it will be observed that the taste-cups in *Epicauta* are unusually abundant.

*Eleodes obsoleta* (Say). — In this tenebrionid from Montana, the epipharynx is provided with a group of from 15 to 20 taste-cups on each side in the middle of a squarish area situated in front of the middle, and whose sides are densely setose.

*Diabrotica vittata* (Fabr.).—In the common striped squash beetle the labrum is suddenly and deeply notched, though there is no trace of a median suture behind the notch. The epipharynx has a singular armature. Just within the bottom of the labral notch on the under side is a row of four, broad, conical setae, whose tips just reach the bottom of the notch. Along the front edge on each side of the notch is a row of most singular broad, flat, thin, leaf-like setae which are closely appressed to the broad, naked, epipharyngeal margin. The surface of the epipharynx is pilose, but the median region is naked, and on the anterior half bears from 11 to 12 taste-cups, arranged each side of the median line in a rude Y. On each side at the base of the labial region are two sensory fields, each bearing about 25 to 26 taste-cups. More were seen under the clypeus.

*Leptura canadensis* Fabr. — Front edge of the labrum and epipharynx densely fringed with slender, curved, truncated setae. I can see numerous taste-cups under the base of the labrum, and what seems to be scattered taste-cups in front, but the labrum is too opaque for a clear view of them.

*Euryptera lateralis* Oliv. — In a specimen from Florida the epipharynx is fringed with long, slender, truncate, slightly curved hairs projecting from the front edge. Taste-cups are abundant along and near the middle of the anterior half of the labral region.

*Cyllene robiniae* Forst. (or *pictus* Drury). — Labrum slightly excavated. Epipharynx with a dense row of long, slender, blunt rods, filling the sinus and extending beyond the edge of the labrum. An area on each side gives rise to very long tactile hairs, between which and the median field of taste-cups is a pilose lateral area. The taste-cups are more numerous than usual, extending in an unbroken sensory field

from near the front margin of the clypeal region to near the front edge of the epipharynx. The cups vary much in size, some being one-half as large as others; and those on the sides of the sensory field bear short, and a few others rather long bristles, showing that the taste-cups are modified tactile bristles.

*Lachnosterna fusca* Fröhl.—Labrum deeply notched, the sides of the sinus armed with large, blunt setae. Epipharnyx bearing on each side, outside of a spring area, a group of about 50 taste-cups, each bearing a long setae, and passing externally into a few high, rather slender papillae, without a seta. On the under side of the clypeus is a median group of 10 taste-cups of singular form, the cups being large, with broad bases which posteriorly bear three spines, of which the median one is the largest. Behind these organs, the membrane is covered with slender "gathering" hairs, which differ from any previously observed in having a nucleus at the base.

In a specimen from Montana belonging to an allied genus, there is a group of about 30 taste-cups, which occupy the same relative position as in the preceeding species.

In *Lucanus dama*, the entire surface of the epipharynx is pilose, and there are no taste-cups, or sensory organs of any kind present.

*Clerus nigripes* Say. — Labrum deeply cleft, but with no trace of a median suture. Surface of the epipharynx not pilose, but with scattered defence setae. Near the edge of the bottom of the sinus is a group of 4 or 5 taste-cups, situated on each side of the median line, each bearing a small, acute bristle. Behind these, under the clypeus are two groups of 10 taste-cups each, situated some distance from the median line.

*Telephorus rotundicollis* Say.—Labrum notched. The epipharynx is quite unlike that of other beetles described, extending quite far in front of the labrum, forming a thin, pale, membranous, pilose edge, and not provided with taste-cups. On each side behind under the clypeus, is a sensory field with 26 taste-cups, which are rather smaller than usual. Over the labral surface are scattered a few taste-cups (?), but they are small and perhaps not gustatory.

*Lucidota punctata* Lec.—In a Floridan specimen the labrum is narrow, rather long, slightly rounded in front, with no traces of a median suture. Under the clypeus is a group of 12 taste-cups, and in the middle region of the labrum situated in a field extending from near the base to near the front edge are about 40 taste-cups, which, however, are not, as is usual, arranged on each side of the median line. The whole surface is pilose, and the taste-cups instead of being as usual, situated in a bare region, are scattered among the hairs forming the pile.

*Buprestis maculiventris* Say. — Epipharynx with a few scattered, peculiar, large setae appressed to the surface, and among them are a few minute, sharp, either curved or straight pegs or setae, which may possibly be gustatory,

but no true taste-cups were observed.

*Corymbites hieroglyphicus* (Say).—Labrum full, slightly notched in front with apparently faint traces of a median suture. Epipharynx pilose, the hairs longest on each side. A few small, scattered taste-cups under the base of the labrum and others scattered along the middle towards the front edge. On each side of the anterior clypeal region is a group of 5 taste-cups.

*Campylus denticornis* Kirby.—Over the pilose surface of the epipharynx are scattered what may be sensory pits, but they are not situated in a bare area, but among the fine hairs, and these organs may be simply tactile.

*Staphylinus violaceus*.—In a specimen from Florida, the structure of the labrum is most singular. It is cleft to its base, being divided into two long lobes, with large long setae, and the deep sinus is filled with very long, densely arranged setae. Epipharynx pilose; under the clypeus, on each side near the middle, is a bare rounded area in which are situated 4-5 papilliform taste-cups, and at the base behind them is another linear group of about 7 slenderer, somewhat curved taste-cups.

*Dytiscus* sp.—In a ♀ Floridan specimen there are on the epipharynx under the clypeus, about 25 taste-cups, which are papilliform, being higher than usual; and on each side under the base of the labrum is a sensory field containing a number of taste-cups.

*Harpalus faunus* Say.—Epipharynx with a median triangular depression beginning at the base and widening towards and ending on the front edge; this trough is lined with a row of spines, which are shortest towards a point lying under the base of the labrum. Over the bottom of the triangular depression (as it appears under the microscope, but in reality the roof of the area) are scattered shorter spines, and since ganglionated nerves can be traced to each of the spines along the front edge, they are evidently at least tactile setae, and not simply adapted for defence. At the bottom of the furrow are four brushes of bristles, and the posterior surface is covered with very fine, short, "gathering hairs." The taste-cups are situated on a narrow linear field, one on each side, lying half-way between the middle and outer edge of the epipharynx, beginning under the middle of the clypeus and extending only to a point situated under the base of the labrum. The taste-cups themselves are in irregular rows, 50 in all, and in addition there is an aggregation of 9 or 10 cups at the anterior and inner end of the gustatory field. Like the others, these aggregated cups bear each a central, short, conical peg. A bundle of thick nerves can be seen ending each at the base of the cup.

*Chlaenius tomentosus* (Say).—The epipharynx bears at a point situated under the base of the labrum midway between the median line and the outer edge, a field on which are situated 25 taste-cups. This area extends towards the middle of the labral region. In front of this region, owing to the capacity of the labrum itself, no taste-cups could be detected.

*Calosoma calidum* (Fabr.). — Labrum very deeply cleft; the sides of the cleft lined with long bristles. There are about 45 taste-cups on each side under the base of the labrum. The cups are papilliform, being rather high, with a seta arising from each.

*Cicindela hirticollis* Say.—In a Floridan example, the structure of the epipharynx is singular; there are no taste-cups, except a few on two large, round, raised areas, which are guarded in front by a few very long setae. On the surface of each area are numerous very long setae which may if not tactile, have some other sense, as they arise from cup-like bases or cells. Those on the outside are like true taste-cups, with a bristle but little larger than normal in taste-cups generally. I am disposed to regard this sensory field as a highly specialized gustatory aparatus.

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## VARIATION OF COLOR IN THE LARVAE OF SPHINX GORDIUS.

In September, 1888, we found, in Nonquitt, Mass., feeding on sweet fern (*Comptonia asplenifolia*) and low huckleberry (*Gaylussacia dumosa*) five larvae of peculiar coloring. The head was large, rounded, green, with face-lines of pale yellow-green, edged behind with black. Mouth-parts dark.

The body was 2 inches long, of a very dark olive-green overlaid with deep wine-color, especially on the back. It was *very smooth* in every specimen, and irregularly dotted with white points encircled with black, except the anal shield, which was dotted with black.

There were seven white obliques, shaded above with a little crimson, then edged with *very* dark wine-color.

Caudal horn was black with no side lines.

Anal shield edged with light green.

Spiracles were red lines set in light green spaces, and inconspicuous except the first segment.

Feet red; props of body color, being lighter on the under side.

On June 16th, 1889, one of the pupae formed by these larvae gave *Gordius* ♂.

We can find no mention of such coloring in any of the books to which we have access, and it differs much from that of the ordinary larvae, of which we had fifteen or twenty.

*Ida M. Eliot, Caroline G. Soule.*

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## PROCEEDINGS OF SOCIETIES.

### COLORADO BIOLOGICAL ASSOCIATION.

REPORT ON ENTOMOLOGY — JAN., FEB., MARCH, 1889. —The membership now numbers 51; the following entomologists have joined during the past three months: Lord Walsingham, Mr. W. S. Foster, Dr. Geo. H: Horn, Mr. J. Jenner Weir, Prof. A. S. Packard, Rev. C. J. S. Bethune, Mr. H: Edwards, and Mr. John T. Carrington.

The additions to the insect-fauna of Colorado, recorded in the books of the association, are as follows: coleoptera, 118 and 2 vars; hymenoptera, 68; orthoptera, 1; rhopalocera, 6 and 3 vars.; heterocera, 76 and 4 vars.; homoptera 5; heteroptera, 5; diptera, 9 and 1 var.; arachnida, 3 and 2 vars. Several of the hymenoptera are undescribed, but will be fully dealt with by Mr. Ashmead, who has in preparation a list of the hymenoptera of Colorado.

Nine reports have been published, containing, among other entomological matter, accounts of the tent caterpillar, the Colorado cabbage flea-beetle (*Phyllotreta pusilla*), the thistle-bud fly (*Scriptotricha culta*), the large flat-headed pine borer (*Chalcophora virginiensis*), and *Euryomia inda*.

The library has been enriched by numerous additions, notices of which have appeared in the weekly reports.

A meeting was held at West Cliff on 19 Jan.: the secretary read a paper on ichneumons.

Owing to the time of year, but little field-work has been done, and our energies have been mostly directed to the identification and classification of specimens captured last year. Mr. Horace G. Smith, Jr., of Denver, has submitted a small but interesting collection of butterflies from Arapahoe co., to Mr. H. W. Nash, and among them he finds a ♂ *Callidryas philea* L, which is new for Colorado, and also an example of *Paphia troglodyta*, and one of *Papilio rutulus*. Mr. W. S. Foster has sent some valuable notes on his captures at Salida and in Marshall Pass, the latter locality being above 10,000 feet. Mr. H. W. Nash sends a note of the occurrence of *Nisoniades alpheus* Edw., in Pueblo co.

Numerous species of insects have been kindly examined and identified by Prof. C. V. Riley, Dr. Geo. H. Horn, Dr. John Hamilton, Prof. A. S. Packard, Mr. W: H. Ashmead, Mr. W: H. Edwards and Lord Walsingham.

*T. D. A. Cockerell (Secretary)*

PSYCHE

A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 160-164.**

AUGUST–DECEMBER 1889.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

[Entered as second class mail matter.]

# CONTRIBUTION TO A LIST OF THE COLEOPTERA OF THE LOWER PENINSULA OF MICHIGAN.

BY TYLER TOWNSEND, WASHINGTON, D. C.

The coleoptera, embracing 161 species, which appear in this list were all, with 9 designated exceptions, collected by the writer in the vicinity of Constantine, Saint Joseph county, Michigan, and form additions to the species given by Hubbard and Schwarz in their "Contribution to a list of the coleoptera of the lower peninsula of Michigan" (Proc. Amer. philos. soc., 1878, v. 17, p. 643-666). The exceptions to the locality of Constantine referred to consist of 9 species which have been recorded elsewhere in the lower peninsula but are not included in the H. & S. list; and the localities of these, whether general or special, are appended, the authorities for the same appearing after them in brackets.

For aid in the matter of determinations the writer is indebted to Dr. C. V. Riley, Mr. E. A. Schwarz of the Department of agriculture, and Mr. M. L. Linell of the National museum; also to Dr. G. H. Horn of Philadelphia, who kindly determined a portion of the species several years ago. A very large number of the coleoptera recorded by Hubbard and Schwarz as occurring in the lower peninsula of Michigan have been locally verified by being collected in Saint Joseph county, but are omitted from publication, as this simple additional list will prove much more useful. The species mentioned here, as well as all those collected in this locality, now form a part of the National museum collection.

In several genera, notably of *staphylinidae*, unnamed species have been collected, but those belonging to genera represented in the H. & S. list are not inserted, unnamed species being designated only in such genera as have not been recorded for the fauna.

## CICINDELIDAE.

Cicindela 6-guttata F. var. patruela Dej.
punctulata F.

## CARABIDAE.

Blethisa quadricollis Hald.
Pasimachus elongatus Lec.
Myas coracinus Say.
Diplochila impressicollis Dej.
Platynus tenuis Lec.
Galerita lecontei Dej.
Helluomorpha bicolor Harr.

Brachynus minutus Harr.
perplexus Dej.
? lateralis Dej.
Chlaenius ? laticollis Say.
nemoralis Say.
circumcinctus Say.
Brachylobus lithophilus Say.

### Dytiscidae.

Agabus taeniolatus Harr.
Dytiscus verticalis Say.

### Hydrophilidae.

Helophorus lacustris Lec.
Hydrobius tessellatus Ziegl.

### Silphidae.

Necrophorus guttula Mots.

### Staphylinidae.

Homalota plana Gyll.
festinans Er.
elevata Fauv.
Callicerus n. sp.
Aleochara bimaculata Grav.
Haploglossa n. sp.
Microglossa suturalis Mann.
Oxypoda minuta Sachse.
Silusa n. sp.
Philonthus umbrinus Grav.
varians Payk.
longicornis Steph.
sordidus Grav.
microphthalmus Horn.
Stenus arculus Er.
Lathrobium anale Lec.
Boletobius exoletus Er.
Homalium humerosum Fauv.

### Coccinellidae.

Hippodamia glacialis F.
convergens Guér.
Adalia frigida Schn.
Brachyacantha ursina F. (large form.)

### Erotylidae.

Languria bicolor F.

### Cucujidae.

Laemophlaeus modestus Say.
punctatus Lec.
pusillus Sch.

### Dermestidae.

Dermestes pulcher Lec.
Trogoderma ornatum Say.

### Histeridae.

Hister vernus Say.

### Nitidulidae.

Carpophilus corticinus Er.
Epuraea aestiva L.
Rhizophagus bipunctatus Say.

### Latridiidae.

Corticaria villosa Zimm.

### Trogositidae.

Tenebrioides castanea Melsh. var. laticollis Horn.
Bactridium striolatum Reit.

### Parnidae.

Dryops fastigiatus Say.
Macronychus glabratus Say.

DASCYLLIDAE.

Scirtes orbiculatus F.
Cyphon variabilis Thunb. (yellow form.)

ELATERIDAE.

Adelocera brevicornis Lec.
Cardiophorus gagates Er.
tenebrosus Lec.
Elater manipularis Cand.
Melanotus macer Lec.
paganus Cand.

BUPRESTIDAE.

Chalcophora liberta Germ. Mich. [Cook.]
Agrilus otiosus Say.
Brachys aeruginosa Gory.

LAMPYRIDAE.

Calopteron ? terminale Say.
Plateros canaliculatus Say.
Telephorus marginellus Lec.

CLERIDAE.

Cymatodera brunnea Melsh.
bicolor Say.
Chariessa pilosa Forst.

PTINIDAE.

Amphicerus bicaudatus Say. Mich. [Cook.]
Dinoderus ? densus Lec.
Lyctus striatus Melsh.

CIOIDAE.

Cis chevrolatii Mellié.

SCARABAEIDAE.

Canthon laevis Drury.
Phanaeus carnifex L.
Geotrupes opacus Hald.
Trox suberosus F.
erinaceus Lec.
terrestris Say.
Lachnosterna prunina Lec.
Anomala binotata Gyll.
undulata Melsh.
Chalepus trachypygus Burm.
Euphoria sepulchralis F.
Osmoderma eremicola Knoch.
Valgus canaliculatus F.
squamiger Beauv.

CERAMBYCIDAE.

Phymatodes amoenus Say.
dimidiatus Kirby.
Romaleum atomarium Drury.
Elaphidion mucronatum F.
Plagionotus speciosus Say. Mich [Cook.]
Rhagium lineatum Oliv. Pine regions. [Cook.]
Strangalia famelica Newm.
luteicornis F.
bicolor Swed.
Typocerus lugubris Say.
sinuatus Newm.
Leptura exigua Newm.
canadensis F.
Monohammus titillator F. Pine regions. [Cook.]
Goes pulchra Hald.
pulverulenta Hald.
Hyperplatys aspersus Say.
Saperda candida F. Mich. [Cook.]
Tetraopes quinquemaculatus Hald.

inent on the upper surface, and are about one-fourth of an inch in diameter. Each gall produces three of four small gall-flies that emerge about the first of July, copulating immediately and then disappearing. Where they went nobody knew, or seemed to know till I found out their secret last spring.

Before the leaves appeared I visited a thicket of young oaks where I had found these galls very abundant in past years, hoping to find their progenitor—whoever she might be—ovipositing in the buds of these oaks—but I was too early; she had not begun her work. But where was she napping at the time? This question was not by any means a new one to me.

The soft, sandy loam at the roots of a clump of oak bushes,—softer because of the effects of the frost that had but recently left it,—yielded to my fingers and I soon had one of the main roots laid bare. Judge of the joyful surprise it gave me to find the bark of this root a solid mass of blister like swellings.

Removing a portion of it with my knife I found it literally full of minute larvae, each imbedded in a mass of living vegetable pulp, but so very small and immature were these larvae that I was certain that they could not arrive at maturity in season for egg-laying in the then swelling buds.

I uncovered other roots of this and other clumps of oaks, always finding more or less of the larvae in the bark, and at length, in some older blisters, I found well grown cynipidous larvae, evidently a year older than those first found, but still their maturity seemed too far off for the work to be done within the next few days.

I collected on that and several close succeeding days a quantity of bark containing larvae, and, placing it in sand, and in a glass case, found after three or four days that several perfect gall-flies had come out. Within a week or so quite a number appeared, but the bark deprived of the sap of the tree, no longer furnished food for the young larvae and they died.

That nature, provident against the extinction of her children, in this case, keeps two generations in the larval state at the same time seems absolutely certain, and I feel nearly sure there are really three; that the larger larvae noticed will not appear until next spring, and that the perfect insects were in that state at the time I first found the galls.

But I am asked: How do you know that these root gall-flies are the producers of the *futilis* galls? Perhaps I cannot convince the querist, but the proof I have to offer is as follows:

Suffering in health from too close confinement in my place of business during the winter, as soon as the weather would permit, I spent a part of nearly every pleasant day in the open air. I improved these hours in watching my pets in the woods and thickets. I found hundreds of gall-flies ovipositing in the buds of oaks of various species, flies of several species, and one of these I found abundant on the low white oak bushes. I captured many of them but left unmolested far more than I cap

tured, marking the trees and the very twigs on which they were at work. Waiting till the leaves were fully grown I found these oaks bore *futilis* galls in abundance, but no other species, and comparing the flies I captured with those I got from the bark galls found them to be identical. Of their identity there can be no doubt whatever.

But I am asked: Do they agree in character with the flies from the *futilis* galls? They do not; and they would, no doubt, be described as a different species. They are many times larger than the *futilis* flies, and there are other points of difference. But this variation was to be looked for, developed, as the two generations are, under conditions so widely different.

Dr. Adler and other European entomologists, who have followed the life history of these insects more closely than I have been able to do, have found that the two generations differ so widely that they have been classed, by those who were not aware of their close relationship, not only as two different species, but have actually been placed in different genera.

I name and describe this insect as follows:

*Callirhytis radicis*, Bass. (agamous form of *N. futilis*, O. S.) Head black and opaque, face, cheeks and vertex with short, bristle-like hairs. Antennae very short, with fourteen distinct joints; the first joint short and thick, the second globular (scarcely ovate); length of the third one-fourth less than that of the two preceeding, the diameter of each from the eighth to the fourteenth inclusive equals their length; the last forms a very blunt cone. Color of the antennae dark reddish brown, changing gradually to a dull dusky brown towards the apex.

Thorax black, the punctuation fine and beautifully regular and even. Parapsidal grooves extending throughout, broad, shining lines over the base of the wings, a narrow but distinct median line from the collare to the scutellum and two parallel lines, one each side or the median line and in close proximity to it, reaching half way from the collare to the scutellum.

Scutellum coarsely and irregularly wrinkled, the fovae round, deep and shining.

Abdomen large, black with brown translucent edges; second segment very long and with a dense band of yellowish white hairs on the anterior margin, the third segment mostly, and the remaining ones quite concealed.

Legs: trochanter black, the remaining joints very dark cinnamon brown. Claws black, simple. Wings large, hyaline; principal veins pale brown, others colorless; radial area broad, the angle of the first transverse vein projecting sharply into the basal portion; areolet very small and the lateral veins bounding it entirely colorless.

Length: body, .15; antennae, 09; wings, .16.

Those taken in the act of ovipositing are in all respects like those described except that the color of the antennae, legs and wings is a trifle darker,—owing,

no doubt, to the fact that these were exposed to the sunlight while the others were not.

Females reared from *futilis* galls this season are .10 in length; the wings .10 and the antennæ .07 with thirteen joints only, with a partial suture on one side of the terminal joint.

The median line on the thorax entirely wanting; the head less hairy but with a few scattered hairs on the thorax and on the sides of the second abdominal segment. The wing-veins are a darker brown.

The galls are blister-like swellings in the smooth bark of the roots of young white oak trees, completely covering the root in some cases for the distance of two feet or more from the tree.

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NOTE.—A later examination of these insects in a strong light shows that the head and abdomen are really a very dark reddish brown. In ordinary reflected light they are easily taken for black.

## ON A NEW SPECIES OF PEDIOPSIS.

BY EDWARD P. VAN DUZEE, BUFFALO, N. Y.

To the kindness of Mr. D. W. Coquillett of Los Angeles, California, I am indebted for the opportunity of examining a very interesting lot of *Jassidae* from that locality. Among this material is one insect that deserves special notice. It is a species of *Pediopsis* closely allied to the eastern *viridis*, and still more closely to the European *virescens*. The colors are probably somewhat faded, and possibly altered by an alcoholic bath, but this will scarcely affect the determination of the species. It may be characterized as follows:

PEDIOPSIS OCCIDENTALIS n. sp.

Female.—Form of *P. viridis*, broader and more robust than *P. virescens*. Color dull greenish yellow, uniform; propleura with a black spot; antennal seta brown. Length about 5 mm.

Face as in *virescens*, more distinctly punctured than in *viridis;* front broader below at the base of the clypeus, which is proportionately narrower, and the lorae are much more tumid than in that species or *virescens;* the clypeus is broadly depressed entirely across the apex, while in *viridis* this depression is confined to the narrow submargin on either side before the lora, and is scarcely more extended than in the European species. Antennae pale at base, setae brownish. Pronotum shorter and broader than in either of the allied species; the rugae are less distinct than in *virescens*, but more so than in *viridis*. Propleura with a black spot. Ventral plate as in *virescens*, shorter and broader toward the apex than in *viridis*, the tip emarginate, and the sides distinctly con-

vex, not concave as in our eastern species. In other characters it does not seem to differ from its allies.

Male.—Very similar to *P. viridis;* dull grey- or greenish-brown; elytra subhyaline fulvous-brown; beneath paler; propleura with a black spot. Length about 4 mm.

Face rugosely punctured above, front with shallow punctures; lorae narrow, tumid. Apex of the clypeus narrowly depressed. Antennae pale brown, setae darker, claws brown. Abdomen tinged with rufous. This form hardly differs from the brown males of *viridis;* the pronotum is somewhat more rounded before, the general color is a more uniform greyish-brown, and there is no indication of the dark shade on the basal angles of the scutellum so generally found in the male *viridis.*

California. Described from two females and three males. Nos. 602 ♂ and 603 ♀. Coquillett.

The existence of this species on the Pacific coast suggests a very interesting line of conjecture to which I wish to draw attention here. In *Pediopsis* we find three species of a uniform green color and closely allied structurally but still separable by characters apparently constant, viz: *virescens* ranging over the whole of Europe and Great Britian; *viridis* occupying the whole of North America east of the Rocky Mountains and extending its range southward at least to the southern boundary of the United States; and *occidentalis* with an unknown range on the Pacific coast. The differences between these species have been indicated above. A careful review of these will show that the Californian species is very close to the European while our eastern form differs more widely from both; still in some characters *occidentalis* approaches much nearer to *viridis* than to *virescens*, such as the form and sculpturation of the pronotum, and the general proportions of the whole insect; the form of the clypeus and ventral plate agree very closely with *virescens* and seem to ally the insect most closely with that species. Thus far the females. Of the males I cannot speak as positively; the brown forms occurring with *viridis* and *occidentalis* I have assumed to be the males of these species. In the case of *viridis* I have all but positive proof, but in *occidentalis* analogy has been my only guide. If my assignment of the males is correct we have in *virescens* only green males (I can find no record of a brown form), in *viridis* both green and brown forms, the latter by far the more abundant in New York, and in *occidentalis* only brown males as far as known. The brown males of our American species are scarcely separable, but a few characters seem to be available for this purpose; possibly these brown males are melanic forms dependant on atmospheric conditions for their appearance.

A question naturally suggested by a comparison of these closely allied species is: Where did they originate and how are they related? For an explanation at all satisfactory we must go back to a time before the glacial epoch when doubtless the parent form occupied a

broad territory in the high northern latitudes extending its range more or less over the north of both hemispheres. With the southern advance of the polar ice-sheet this insect was driven far to the south where the oceans and meridional mountain ranges divided the original form into at least three distinct families, which, isolated from each other, and under the influence of different environments, have been modified and become fixed into the species as we now find them. It would but poorly satisfy the conditions of the case to suppose that either form, as at present distinguished, has, after being introduced into the other faunal regions, become modified to the extent we find here.

Therefore we doubtless have here three species of equal value and of the same age although not equally differentiated from one another. The similarity of the climatic conditions surrounding the European and Californian families would naturally produce, as we find to be the case, species more closely related to each other than to the eastern American family, surrounded as it was by greater climatic variations and occupying probably a much larger area. This view of the origin of these little green pediopsids is in full accord with the views of Mr. A. R. Grote. in regard to the origin of the North American lepidopterous fauna, expressed in v. 1 of the *Bulletin of the Buffalo society of natural sciences*, p. 200 and more fully developed in 1884 in v. 18 of the *Canadian entomologist*.

Some portions of the North American homopterous fauua very closely parallel the corresponding European faunas but I apprehend that but few species—such as have been recently introduced, and possibly a few others—will prove to be actually identical with the European forms. These many allied species, suggesting so strongly a common origin, belong to distinctively northern groups that show as marked a parallelism in genera as in species, and seem to be decendants of a tertiary fauna common to the northern parts of both hemispheres, which in adjusting themselves to the conditions imposed on them by glacial action have been modified, some more, some less, but few so little that they can now be declared identical. A comparison of the European and American lists of *Jassidae* will show a very large percentage of northern European genera represented in boreal America. A few peculiar groups of course appear, but when our western hemiptera are better known this general statement will, I am convinced, find strong additional verification.

Of the species of hemiptera common to both sides of the Atlantic some appear to have undergone no change, such are *Cymus claviculus*, *Scolopostethus affinis*, *Leptopterna dolobrata*, *Opsiocoetus personatus*, *Cicadula 6-notatus* etc. Others while practically identical, exhibit modifications of structure or marking, or tend to produce varieties not strictly paralleled in the European facies of the species, e. g. *Hebrus pusillus*, *Philaenus spumarius*, *Athysanus striola*, and possibly *Lygus prat-*

*ensis.* Still others, while but little more widely differentiated are considered as distinct species; there are many of these but a few will answer for illustration, *Eurygaster alternatus* and *E. maurus*, *Neottiglossa undata* and *N. inflexa*, *Triphleps insidiosus* and *T. niger*, *Cixius pini* and *C. stigmaticus*, and *Deltocephalus debilis* and *D. abdominalis.* The first series may probably have been introduced from one faunal region to another, but the two latter series naturally lead us to look back to a common preglacial ancestor whose descendants in the second series have, in accomodating themselves to their changing environments, undergone a similar modification in the different regions, or have exhibited greater stability in resisting these changes. In the third series the change has been a little—sometimes only a very little—more perceptable.

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In *Psyche* v. 5. p. 211-214, Mr. C. W. Woodworth, in an interesting and instructive paper on the genera of the North American typhlocybini, says he has not recognized a single European species of the group from this country; he seems to have been unaware of the fact that *Kybos smaragdulus* occurs not only throughout the northern states and Canada but even as far west as California from whence I have recently received examples from Mr. Coquillett.

## SYNOPSIS OF THE ODONATA OF NORTH AMERICA. No. 1.

BY HERMANN AUGUST HAGEN, CAMBRIDGE, MASS.

Since 1861, when my Synopsis was published by the Smithsonian Institution, I have, of course, studied these Odonata. The specimens described in my first work were never less than three years old, mostly over twenty, some nearly sixty. During my residence here I have always tried to compare fresh specimens, and if possible to describe living ones. There are very few of which thé old types could not be studied again with new specimens. Of the species described since 1861 I have seen the types or had sufficient information by the authors themselves. The localities are given here always as complete and detailed as possible.

### TRIBE I. AGRIONINA.

Eyes distant; antennae four-jointed; wings equal; abdomen cylindrical, slender; accessory male-genitals with the anterior hamulus connate; penis and vesicula separated; female genitals vaginate.

### SUB-FAMILY. CALOPTERYGINA.

Antecubital veins numerous.

### CALOPTERYX LEACH.

Wings broad, densely reticulated; pterostigma absent in the male; in the female absent, or very small, or irregular, areolate; basal space without transverse veins; quadrangular space

straight; legs long, densely spinose; appendages of the male forcipate, of the same shape in all species.

I have given a preliminary notice on the previous stages, Compt. rend. soc. ent. Belge., 1880, May 1; the figures are not yet published.

Larvae slender, elongate; the basal joint of the antennae very strong and twice as long as the other six together; mask elongate, narrow, very dilated on tip, split *en losange* far beyond the base of the palpi; occiput on each side with a prominent spine; legs long, slender, abdomen on tip with three flat pointed gills, the intermediate shorter; there are rectal gills, and stigmata as commonly.

The genus *Calopteryx* largely represented in the northern boreal and temperate zone nowhere passes to the south beyond the 30th degree. The excellent study of De Selys has shown that the species are few, but the varieties and races rather numerous. For the old world three species: *C. virgo*, *C. splendens* and *C. haemorhoidalis* live in Europe and on the northern border of Africa. The first two are to be found also in the northern and western parts of Asia. For the eastern part of Asia and Japan, three species are known, *C. atrata*, *C. cornelia* and *C. grandaeva*. None of these species are found in the new world. De Selys (Odonates de l'Asie mineure, 1887. Ann. soc. entom. Belg.) has given a splendid study of *Calopteryx*. The important race *Corientalis* Selys, p. 40, he considers as proving that *C. syriaca* is a race of *C. splendens*, the more so as some large males Synop. 3 Add., p 7. seem to support this opinion. He was sorry to have seen only the male. Mr. E. Eichwald (Reise auf dem kaspischen meere, 1837, v. 2, p. 272) has described the female. In Lakwish Mingrelia he saw many Odonata metallic blue and metallic green. He believed the latter to be a new species, *Agrion colchicius* (sic!) aeneo viridis, thorace altiore, sulcis inter areas aeneo-virides nigris notato, inferne nebuloso-coerulea, trunco superne aeneo-viridi, ultimis segmentis minimis tumidioribus, flavidis; alis omnibus aequalibus, medio posticis dilatatis, apicibus rotundatis, aenea viridi-nigrescentibus, omnibus antice macula marginali nivea notatis; pedibus nigris, subtus nebuloso-coeruleis, antice longis setis piliformibus instructis; venis alarum parvis (cf Stettin. ent. zeitung, 1856, p. 365).

Group 1. Wings narrow; the hind margin parallel to the front margin. (*Sylphis* Hagen.)

### 1. Calopteryx angustipennis.

*Sylphis angustipennis*, male. Selys Monogr. Cal. 21,2; Synops. Cal. 9,2; 4 Add. 6,1. — Walker Catal. Br. mus. 590,2 — Hagen Syn. Neur. N. A. 56,1; Stett. ent. zeitung, v. 24, 372,24. Proc. Bost. soc. nat. hist. v. 16, 363,51 (the two last on Abbot's figure); Syn. Odon. N. A. 20,1 — McLachlan Ent. mo. mag. v. 10, 227 female, Abbot's type.

*Sylphis elegans*, female. Selys Monogr. Cal. 20,1; pl. 2, f. 1; Synops.

Cal. 9,1; Walker Catal. Br. mus. 590,1.

Male (adult ?); known only by short diagnosis made in 1851 by De Selys and by Abbot's figure, both compared by myself and declared to be similar to the female described as *S. elegans*. Brassy green, labrum and labium and the second joint of the antennae pale yellow, two sharp tubercles behind the occiput; legs very long, spines short, black; appendages similar to *C. virgo*; wings very narrow, pointed, the hind wings eight mm. broad; hyaline, pale greenish, probably also the reticulation; sector principal partly connected with the mediana; 29 antecubitals.

Female, semi-adult; metallic green; labium pale, labrum pale yellow, a little black in the middle of the margin; epistoma metallic green in the middle; sides of the mouth pale yellow head metallic green above, with a yellow spot before the ocelli; second and third joint yellow, of nearly equal length; tubercle on the occiput sharp; colors of the thorax not finished: dorsum metallic green in the middle, reddish-brown to the humeral suture, which is fine and yellow; mesothoracic crista black; sides metallic blue between two lateral yellow bands; below and around the legs yellow; axillary callus steel-blue; legs brown, darker to the knees, thin and very long, the hind legs 26 mm. reaching nearly to the end of the fifth abdominal segment; spines shorter and not so frequent as commonly; wings long, a little pointed on tip, narrow; front wings, 7½ mm. broad on the nodus; hind wings 6½ mm. a little yellowish; reticulation pale reddish; costa steel-blue; 30 antecubitals; 8 in quadrangular space; sector principal very near to the mediana, but not entirely connected; everywhere only one series of cells between two veins; no pterostigma; abdomen metallic green, below blackish; only the five basal segments retained.

Female, adult. Brassy green, shining; labium yellow, blackish in middle; labrum yellow; middle of front-margin finely black, also an impressed basal spot; head and epistoma brassy green; second joint of antenna yellow; thorax brassy green; crista black; humeral suture finely yellow; sides brassy green after the second suture, between the legs, and below dull yellowish; legs black; wings long, a little broader, front wings 9 mm., hind wings 8 mm. broad near the nodus; apex more rounded; a little yellowish, more colored at the base; reticulation black; costa and axillary callus brassy green; 25 antecubitals; 6 to 5 in quadrangular space; sector principal entirely connected with mediana shortly after its origin; no pterostigma; abdomen brassy green, black below; last segments darker brassy, with a white longitudinal band on the three apical ones, broader on the penultimate, smaller on the segment before and on the last, ending on the apical carina; appendages yellow, sharp; sides of last segments and valves yellow, with black palpus.

| | *Male.* | *Female.* | *Female, adult.* |
|---|---|---|---|
| Length, | 67 | 52 | 56 |
| Abdomen, | 56 | 43 | 43 |
| Exp. al.. | 32 | 78 | 78 |

HAB. Briar Creek, Georgia, rare, April 18, Abbot; male type in the Brit. mus. (figured); female Dublin Mus. r. soc. (not seen by me); female type of *S. elegans* out of Berlin mus., bought by me, 1835, with the label written by Count Hoffmansegg, "patria ignota." There was in 1845 no other specimen in the Berlin mus. Female adult Bee Spring, Kentucky, June, by Frank G. Sanborn; both females now in the Cambridge (mus.).

The insufficient material leaves this species doubtful. De Selys and myself have studied the male type in the British museum, and McLachlan the female in Dublin, which he declares to belong to *C. angustipennis*. The female of *S. elegans* is rather young. The character formerly urged by De Selys that the principal sector is connected with the mediana in *S. angustipennis*, and separated in *S. elegans* has been recognized as not so striking. The male type shows the sector very near but separated from the mediana; but male and female are probably both young specimens. The female adult from Kentucky has the sector principal connected with the mediana. This female has the wings a little broader. The difference of this female from *C. amata* is shown by the lack of the pterostigma, by the yellow appendages, black in *C. amata*, and the white band on the last three segments. The differences of the female *S. elegans* may be considered as belonging to its younger age. With our actual knowledge of *Calopteryx* of the whole world there is no doubt that *S. elegans* is a North American species.

2. CALOPTERYX AMATA Hagen, nov. spec.

Male, brassy blue; head bronze, brassy green near occiput, which has on each side a sharp tubercle; epistoma bronze; second joint of antenna yellow; labrum yellow, a basal spot and margin around black; labium yellow, middle part black; thorax brassy blue; dorsal crista black, sides brassy green; around the coxae yellow; a small band below on the first suture and another along the ventral border yellow; legs long, black; hind tibia 11 mm.; abdomen brassy blue, below black; appendages of the typical shape, black; the inferiors below at the base reddish; wings narrow, 9 mm. broad at the nodus, with a yellowish tinge, stronger at the base; costa and axillary callus steel-blue, reticulation black, not very dense; no pterostigma; hind wings brown on the tip for the fourth part of their length, the internal border of the brown straight but not well defined; the tip of the brown spot sometimes brighter; antecubitals about 30; in the quadrangular space 3 to 5.

Female, brassy green; head similar but the yellow labium only with a triangular black basal spot, ending on the beginning of the split; thorax brassy green; dorsal crista black, the humeral suture fine yellow; the yellow color below and around the legs more advanced; the band on the first suture longer; the ventral band broader; legs as in the male; abdomen brassy green, black be-

low; last segments darker brassy, with a broad, dorsal, yellowish white, median band on the penultimate segment, and a narrower one on the last, which ends on the sharp apical carina; appendages black, sharp; sides of last segments and valves yellow, with a black palpus; wings similar, with a more yellowish tinge; a very small yellow pterostigma, a little dilated in middle, variable in size, covering two to five cells, sometimes with transversal; between one and two mm. long, or less.

| | *Male* | *Female* |
|---|---|---|
| Length, | 55 | 48 |
| Abdomen, | 45 | 38 |
| Exp. al., | 75 | 75 |

HAB. Dublin, New Hampshire, near Thorndike pond, 1300 ft. above sea level, 2 females, June 18, 1887, and 4 males and 2 females June 22, 1889, by Mr. Louis Cabot.

The hind wings with brown apical color, and the yellow pterostigma of all females are good characters for *C. amata*.

3. CALOPTERYX DIMIDIATA.

*Calopteryx dimidiata* Burm. Handb. v. 2, 826,16 fem. Selys Monogr. Cal. 24,4. — Syn. Cal. 10,4. — Walker, Catal. Br. mus. 591,4. — Hagen, Syn. Neur. N. A. 56,1; Stett. ent. zeitung, v. 24, 272,25; Proc. Bost. soc. nat. hist. v. 16, 364,52 (both on Abbot's figure).

*Calopteryx cognata* Ramb. Neur. 222,6 female.

*Calopteryx syriaca* Ramb. Neur. 223,9 note, male.

Male, metallic blue, on thorax and end of abdomen changing partly to green; labium, head below and antennae black; labrum and epistoma metallic blue, shining; tubercle on occiput sharp; crista of the thorax, all sutures and below black; legs black; abdomen black below; appendages of the typical shape, black; wings narrow, hyaline with light yellowish tinge, the apical part black, with the inner border of the black straight; reticulation black, costa steel blue; front wings 22 to 27 antecubitals; in the quadrangular space 6 to 8.

Female adult, metallic green, head and prothorax sometimes changing to blue; colors as on the male; thorax more evident in younger specimens with the second suture and the ventral border and below yellowish; legs and the more numerous spines black; hind legs reaching to the beginning of the fourth segment; abdomen very slender, metallic green, last segment dark; below entirely black, appendages black; the lateral border below the appendages with 4 to 5 small teeth; wings hyaline, very slightly yellowish; apex of hind wings brown in the last quarter, the inner margin straight; apex of front wings brownish, not so well defined; pterostigma large, white, dilated in middle, crossed by some transversals; reticulation black; the costa and axillary callus steel blue; the sinus before the wing-base with the posterior border straight; 20 to 25 antecubitals; quadrangular space 4 to 6 transversals.

The young females have the wings hyaline, with a little yellowish tinge, not brown on tips, except a light

brownish shade on hind wings.

| | *Male* | *Female* |
|---|---|---|
| Length, | 50 | 38–45 |
| Abdomen, | 38 | 31–38 |
| Alar. exp., | 58 | 57–64 |

HAB. Kentucky, Burmeister's type; Georgia, Abbot, 25 April, a couple in the collection of Escher Zollikofer in Zürich; H. K. Morrison, both sexes, many specimens. Palatka, St. John's River, March, O. Sacken, and Appalachicola, Florida, R. Thaxter.

### RACE APICALIS.

*Calopteryx apicalis* Burm. Hdb. v. 2, 227,8. Selys Monogr. Cal. 23,3; Synops. Cal. 9,3. Walk. Catal. Br. mus. 591,3. Hagen Synop. Neur. N. A. 56,2; Synops. Odon. N. A. 21,2.

The smallest known species; nearly related to *C. dimidiata* but smaller and more slender; male metallic green or blue; labium, head below black; labrum, epistoma, second joint of antenna brassy green or blue; tubercles on occiput very sharp; thorax metallic green or blue, also the parts near abdomen; all sutures black; thorax below yellowish; legs black, hind legs reaching to the fourth segment; abdomen metallic-blue and green; below black; appendages black, similar to *C. dimidiata*; wings narrow, 7 mm. broad, hyaline, the sixth part of the apex black, with inner border straight; reticulation black, costa steel blue; antecubitals 18 to 23; quadrangular space 4 to 6 transversals; sinus before the wings with the posterior border sinuated.

Female similar to the male, brassy green; second suture of thorax and the abdominal border, and below yellow; apical segment of the abdomen below with two teeth on the border; wings hyaline without pterostigma or with a very small white one, filling one cell, or a little dilated in three cells; reticulation black, costa steel-blue.

| | *Male* | *Female* |
|---|---|---|
| Length, | 43–45 | 43 |
| Abdomen, | 35–37 | 32 |
| Exp. alar., | 57 | 57 |

HAB. Burmeister's types from Philadelphia, Pa.; two males, one female without pterostigma; a couple from the same locality by Ph. R. Uhler with a small pterostigma. Waltham, Mass., July 21, 1864, by Ph. R. Uhler one male and two females, with a more developed pterostigma; South Reading, Mass., by Frank Stone.

GROUP 2. Wings dilated; the hind margin visibly rounded.

### 4. CALOPTERYX AEQUABILIS.

CALOPTERYX AEQUABILIS Say. Journ. acad. Philad. v. 8., 23,2. Edit. Le Conte, v. 2, p. 405. Hag. Proc. Bost. soc. nat. hist. v. 15, 274,40.

Male, steel blue or brassy green; head dark, somewhat brassy; tubercles of occiput short, blunt; antennae black; labrum black; thorax with a fine, wavy, yellow line above the legs; upper appendages black, strong, curvate, the apical half externally with strong spines, internally dilated, after an excision followed by a short tooth;

inferiors a little shorter, straight, stout, flattened on tip, black; basal half below as well as the last segment, and the part before the valves of the segment bright yellow; legs black; wings hyaline, with yellowish tinge on the base; tip large blackish; fuliginous, occupying the fourth of the length on the front wings, inside ending in a convex but rather suffuse border, occupying the apical third of the hind wings, ending inside in a straight border; venation black, costa steel blue; 26 to 30 antecubitals, 6 in the quadrangle; one series of cells between the veins; postcostal space with nearly simple net of cells.

Female, similar to the male but entirely brassy green; labrum yellow, bordered with black anteriorly and on the basis, with a median triangular spot not reaching the anterior border; second joint of antenna yellow externally; thorax above the base of the legs and along the second suture yellow: abdomen brighter, a dorsal median band, the sides and valves yellow; wings with a stronger yellowish tinge, the apex of the front wings somewhat smoky; third apical part of the hind wings more decidedly smoky, but the inner border suffused, not well defined; pterostigma large, white; feet black.

| | *Male* | *Female* |
|---|---|---|
| Length, | 45–60 | 46 |
| Length abd., | 36–40 | 38 |
| Exp. al., | 60–68 | 71 |

| | *Female* |
|---|---|
| Lat. al., | 9 |
| Long tib. post., | 10 |
| Pterost. | 2 |

HAB. Montreal June 12 to 26, Mr. H. H. Lyman, male and female ;Quebec, Canada, Mr. Provancher, male; Norway Maine; Mr. S. I. Smith, male and female; Bethel, Maine, L. Agassiz, female; Brookline Mass. and Tyngsboro, Mass., Mr. C. S. Minot; Lawrence, Mass., Mr. J. H. Treat, male, 16 specimens.

Race HUDSONICA, Hag.

*Calopteryx hudsonica*, Hag. 1875. Selys, 4 Add. p. 7, 6 bis.

I have before me only one male, end of abdomen wanting, and two females, one of them a fragment. All are collected by Mr. Barnston at Michipicoten Lake Superior, northern shore.

Until now I have not seen good and sufficient specimens of *C. aequabilis*. I am now of the opinion that *C. hudsonica* is not specifically different from *C. aequabilis*. There are some characters, which may be striking enough to allow it to be considered as a peculiar race. First, it is visibly stronger and more bulky in the thorax, head and abdomen. The dimensions are not larger than the largest ones noted for *C. aequabilis*. The male has the legs pale, which may be due to a lack of development, as I do not find pale legs in a younger male from Norway, Me. The wings are a little stronger tinged; antecubitals 33. The females are older, the colors more finished. More specimens are needed before a satisfactory conclusion can be reached. The female, described from Hudsons Bay, is similar. Perhaps the *C. virgo* from Greenland mentioned

by O. Fabricius, and seen by nobody later, may nevertheless belong to this species, as it is not credible that O. Fabricius could have mistaken this well known and striking insect.

### Race Yakima.

*Calopteryx yakima* Hag. n. sp.*

Male, steel blue; head dark; labium and antenna black; tubercles of occiput blunt, short; thorax brassy, sides with a very fine. transversal, yellow line above the legs; upper appendages black, strong, curved, with a number of strong spines on the apical half externally, dilated on the same half internally, the dilatation beginning after a tooth, tip rounded; inferiors a little shorter, stout, somewhat flattened, on tip, black; yellow below on basal half; last segment, and the segment before the genital valves yellow below; wings hyaline, base a little yellowish, apical third, a little more on hind wings black, internally cut in a straight line; venation black; costa steel blue; 22 to 30 antecubitals; 8 transversals in the quadrangular; feet black with long spines.

Female, dark brassy green; labrum black on each side, with an oval yellow transversal spot; second joint of antennae yellow at base externally; sides of thorax with larger yellow bands above the legs, prolonged at the transversal sutures; appendages black, long, pointed; a broad, yellow, dorsal band on the penultimate segment, and a narrower one on the last segment; the final dorsal spine black; valves yellow; wings as in the male, hyaline, more yellowish at the front border to the nodus; apex blackish exactly in the same manner, but not so dark, as all specimens are younger; pterostigma milk-white, 2½ mm. long.

Hab. At a place called Lone Tree, near the Yakima River in Washington Territory, collected by my assistants and myself, 13 specimens, 5 of them males; June 30 to July 18, 1882; all more or less with unfinished colors except two males, which were among the first lot, collected in June.

Long corp. 51 mm.: abdomen 40; wings 32; tibia post. 11.

The discovery of a species of *Calopteryx* west of the Rocky Mountains, was very unexpected and rather startling, the more as the species seemed to be different from all known to occur in North America. The nearest eastern speci.s is *C. hudsonica* from Michipicoten on the northern shore of the Lake Superior and still farther east *C. aequabilis.* During the last years my attention was drawn to the appearance of western species in the eastern states, namely in the northern part of western New York. One of the most striking of my discoveries is the identity of *Cordulia lintneri* collected from Center, N. Y., with *Lib. vacua* Hag. (no descr.) from Saskatchewan and Lake Winnipeg. I cannot but believe that some of the northwestern species pass east by the passage above Missoula, Montana, where the principal range of

*Yakima is a nomen proprium as matrona, margarita, sappho, etc.

the Rocky Mountains ends, and perhaps by the upper parts of the Columbia River. As far as I know, such species are to be found along the northern shore of Lake Superior and then cross over to western New York; such species are, until now, not to be found in eastern Canada or in Maine. Of course when species can come east in such a way, it is possible that some could go west in the same way, and would be, perhaps, modified by the climate. So I found it necessary to compare carefully with *C. yakima* the *C. hudsonica* from Michipicoten and *C. aequabilis.*

5. CALOPTERYX MACULATA.

*Agrion maculata* Palis. Beauvois 85 pl. 7, f. 3 (aberratio).

*Calopteryx maculata* Burm. Hdb. v. 2, 829,17. Rbr. Neur. 222,5. Selys. Monogr. Cal. 27,5; Synops. Cal. 10,5. Walker, Catal. Br. mus. 592,5. Hagen Synops. Neur. N. A. 57,4; Synops. Odon. N.A. 22,6; Stett. ent. zeitung, v. 24, 372,26; Proc. Bost. soc. nat. hist. v. 15, 274,40; v. 16, 364,53.

*Calopteryx opaca* Say Journ. acad. Philad. v. 8, 32,2 male.

*Calopteryz materna* Say Journ. acad. Philad. v. 8, 32,1, fem. (Drury L pl. 42, f 2).

*Calopteryx holosericea* Burm. Hdb. v. 2, 828,13. Rbr. Neur. 226,14 (erroneously f. Java).

*Libellula virgo* Drury v. 1, 113 pl. 48, f. 2; edit. Westw. 118.

*Calopteryx papilionacea* Rbr. Neur. 222,6.

Male, metallic blue; head below and second joint of antenna black; labrum black, shining; tubercles of occiput blunt, more or less short; thorax metallic blue, sides and below black; legs black; abdomen metallic blue, the last segments below and the inferior appendages below entirely reddish; wings dilated in the middle, rounded below, black more brown on base, which is on the base more or less hyaline; reticulation very dense.

Adult males sometime occur with irregular hyaline spots, figured by Palisot Beauvois as his *Agr. maculata.*

Male junior, similar, but the wings hyaline, pale gray; axillary callus and costa steel-blue.

Female, head and thorax metallic green or brown; abdomen brassy brown; last three segments with a pale yellowish band, broader on the penultimate; black below; wings very variable in shape and color; sometimes as broad as third of the length; always a milk-white pterostigma, quadrangular, the corners rounded, 2 mm. long, or very large oval, 4 mm. long; color as the younger males, with a brownish tinge, darker along the basal half of the costa and on the apex of the hind wings; sometimes darker brown with the apical quarter of the hind wings or also the front wings dark brown; the darkest colors in the south from S. Carolina to Florida; the northern specimens paler.

Antecubitals less than 30, rarely 19; quadrangular space 5 to 9 transversals, or a few more.

| | *Male* | *Female* |
|---|---|---|
| Length, | 44–48 | 32–50 |
| Abdomen, | 34–40 | 30–32 |
| Expan. alar. | 50–66 | 54–66 |

HAB. Common, nearly everywhere. I have seen the types of Burmeister, Rambur, Selys and Say in Harris collection. Canada, Quebec; Maine, Norway; Massachusetts, everywhere; New York; Wisconsin, Upper Wisconsin River; Illinois; Ohio; Maryland; Kentucky; Kansas; N. Carolina; S. Carolina; Georgia; Washington, D. C.; Tennessee; Florida; Texas.

The species described will perhaps have to be reduced to four. The material known for *C. angustipennis* is decidedly not adequate; if a larger number should prove the differences given for *C. amata* not persistent, the two species will belong together. I acknowledge this to be possible; after our actual knowledge the union can not be proposed on mere guessing.

*C. dimidiata* and *C. apicalis* have to be accepted as belonging to the same species.

*C. aequabilis* has nothing to do with *C. dimidiata*. *C. maculata* is very striking, and surely different from all the other species.

*C. splendens* Hagen Synops. Neur. N. A. 58.6 is surely not to be found here. It was quoted after a specimen in Escher Zollikofer's collection, said to have been sent from Georgia by Abbot.

## A CONTRIBUTION TOWARDS A KNOWLEDGE OF TERMITES.[1]

BY BATTISTA GRASSI, CATANIA.

We will begin with *Calotermes flavicollis*. I am able to state that individuals (young nymphs) provided with short wings,[2] wing pad of Hagen, can be developed into supplementary kings and queens.

These supplementary kings and queens are:

1. Individuals (youngest larvae of Fritz Müller) which are not developed enough to be considered either as soldiers (in *Calotermes* there are no workers) or as sexually mature forms with fully developed wings (winged individuals of Fritz Müller.)

2. Sexually mature larvae and nymphs with longer or shorter wings. I have some supplementary kings and queens two and three years of age which show the same characters that they did at the time of their election, and consequently they do not show the slightest development of the wings, the color of the body alone has become darker (yellowish brown).

The sexual organs of the supplementary kings and queens are identical with those of the true kings and queens. The anal appendages which are always present in the true queen are often

[1] Translated from Entomologische Nachrichten, Juli, 1889, 15 Jahrg, No. 14, p. 213-219.

[2] I use this term in the Fritz Müller sense, for the first formation of the wing, just as wing-stump (scale) is used for what remains after the wing is torn off.

wanting in the supplementary queen; they are always present in the supplementary king and the true king.

I have tried very many times to produce supplementary kings and queens, but always with the same results, which I have already published.

We will now take up my observations on *Termes lucifugus*.

The nymphs of the second form (*Lespès*) usually become mature about the month of August, almost always in the nymph form with longer or shorter wings. Their comparison with the supplementary kings and queens must therefore be accepted as proved, although it depends here upon a complicated and unusual phenomenon which gives the colony of *Termes lucifugus* a very peculiar appearance. I have studied the termites for more than five years and among thousands and thousands of *Termes lucifugus* have never succeeded in finding a true king or queen with wing-stumps, that is to say the remaining stumps after the perfect wings have been torn off.

In past years I have had many little colonies of winged individuals confined in cages and later in the natural course met with true kings and queens. If one looks for *Termes lucifugus* about the middle of the month of May in the dead wood of certain kinds of trees he will find youngest larvae, larvae of various stages. many young nymphs of the second form, partly of the male and, partly of the female sex, and many individuals incapable of reproduction (workers and soldiers) whilst in other trees, chiefly in the dead roots, in addition to all the above mentioned larval stages and nymphs of the second form, many masses of eggs in different stages of development and hundreds or indeed even thousands of mature females with swollen abdomens and showing a certain quantity of small roundish bodies (spermatozoa) in their spermatheca.

That the above mentioned eggs were laid by these females one can easily convince himself if he will place some of the latter in a frame with a few pieces of moist tender wood—it is understood that the transfer of the eggs has been guarded against—and leave them undisturbed; after one or two days they begin egg-laying and soon find for themselves different nests in the frame. These females can be directly separated from the nymphs of the second form, possessing of course the characteristics already mentioned by me in another place, that is short wings, brown facetted eyes, etc., and are to be compared therefore with the supplementary queens (I shall call them complementary queens.)

In the preceeding month, April, one finds out of doors almost the same conditions except that the nymphs of the second form (there exist nevertheless many larvae capable of reproduction) and the eggs are wanting, whilst the winged forms swarm in hundreds or thousands.

During the winter months (from December to March) the termite colony appears to us almost exactly as it does in April, in place of the winged forms

you find nymphs, that is nymphs of the first form. In general the development of the termites ceases during the winter months. For the autumn months my observations are incomplete. It is nevertheless certain that in the month of August the nymphs of the second form have already become complementary kings and queens; they conceal themselves in the remotest parts of the nest, copulate and the queen lays eggs until November. The complementary kings as a rule die before the beginning of winter, only a few live until December. I have never found one of them after the month of December.

Taking all these important facts together and many others which I have but partially given here we come to the following conclusions; the termite colony produces yearly an immense number of sexually mature individuals. Those mature in spring, acquire completely developed wings (winged forms) and leave the mother nest in order as kings and queens to form a new colony, a happiness however they but rarely share (in this I partly agree with Fritz Müller).

But those which mature in summer acquire only wing-pads, remain in the nest, copulate and reproduce (complementary kings and queens). The complementary kings die before the beginning of winter so that the queens are left alone; the latter cease to lay eggs during the winter and spring, but in May they commence again when they make use of the spermatozoa they have had in their spermatheca since the preceding fall. How long these complementary queens are able to live I do not surely know, but you find some of a dusky (yellowish-brown) color, somewhat like the nymphs of the second form, and others wholly of a dark brown color, many of these have longer wings than the others and this occurs not only with the dark brown forms but also with those of a yellowish brown color. All the complementary queens which are found in the same colony have very nearly the same color and but little variation in the length of the wings. Whilst therefore the difference in color in the complementary queens might at first sight lead us to think that they live several years, my additional facts make it much more probable that they die about the month of August and certainly by the time the new complementary kings and queens mature. The difference in color shows therefore a simple variation just as the difference in the length of the wings. However we will leave the definite solution of this question for future research and we come now to the results of the yearly production of complementary kings and queens. We will suppose that in one place tree A is found invaded by *Termes*, then we shall see after a certain time, that is when the population (living colony) in the above tree A has reached a certain size, the colony extends to the neighboring tree B; the complementary queen however remains in the first tree A. The extension takes place either under ground or directly in the air thus it frequently happens

that we discover the *Termes* underground between two trees occupied by *Termes* or also find trees, the dead parts of which are inhabited by *Termes* without being able to find the slightest sign of a communication with the neighboring nest.

One easily sees that he only has a partial nest from the fact that the complementary queen is found in one of these trees whilst she is wanting in all the others; all other individuals including the youngest larvae are found in both trees only the latter are in far greater numbers in the tree in which the complementary queens are found. If we suppose that the above migration from tree A to tree B to have taken place in the month of March then we shall find in April that nymphs of the second form exist in the tree A as well as the tree B and that in August numerous pairs of complementary kings and queens have developed in both trees from these nymphs of the second form.

In the natural course of time thousands of other trees can be infested from the described tree B and thus a whole territory may be invaded from a single colony; in the same way the *Termes* colony is immortal and compensates for the great difficulty in the foundation of new colonies.

However if we take a fragment of a termite nest without a royal pair at a time when the nymphs of the second form have not yet developed or such a fragment in which only some few of the same are to be found and insulate it so thoroughly that no communication with the mother nest can take place, we shall then see individual *Termes* more or less numerous 20-30-40 which are still undifferentiated (youngest larvae) or young larvae capable of reproduction, that is to say provided only with the first rudiments of the wings, bring forth supplementary kings and queens. It is very probable also that the nymphs of the first form can be metamorphosed into supplementary kings and queens, but I could not determine this, however I deny that the workers or soldiers of both of these stages can be changed into supplementary kings and queens.

The following is another important fact; in each termite nest in which nymphs of the first form, or white winged ones, are found there are always two or three females to one male. On the other hand one will find at the end of the period of swarming, that is at the time when only a few nests swarming with winged individuals are to be met with, in each one of the nests among these winged ones, either only males or only females, very rarely one finds a male among the females.

How these occurrences were related to each other during the time of the greatest swarming I was unfortunately unable to observe, but conjecture that the females were confined to one part of the nest and the males to another part and that they migrated independently of each other and also at two different times. The object of this being to prevent the formation of new colonies between close blood relations, a formation which I sometimes obtained by skil-

fully placing a certain number of white winged forms taken from one and the same nest beneath a frame. The involuntary inhabitants of these frames changed their color, lost their wings to the scale, copulated and never attempted to leave their case and in May the females began to lay eggs.

In what way are the complementary or supplementary king and queen developed? Alas for this answer I must confess myself at fault but I can state for the *Calotermes* as well as for the *Termes* that all individuals during the time of casting their skins lose the protozoa which they have in their caecum in greater or less quantities. Immediately after casting the skin they acquire them again except such individuals as are designed for supplementary or complementary kings and queens do not acquire the protozoa again (the fact is proved in one to five hundred supplementary and complementary kings and queens from many nests); very soon they become darker colored and by degrees they are sexually mature. Meanwhile the usual food was continued, whether it was at any time added to I do not know but it is certain, as I have already said, that the protozoa do not appear again. But if we consider that the mass of the protozoa in the soldiers, workers and the larvae is always the same, that they change the caecum into a sac which presses on the sexual organs so that one involuntarily believes that these protozoa must be the cause of the infertility of the soldiers and workers[1] and that the *Termes* by avoiding these protozoa can hasten the sexual maturity of the individuals destined for supplementary and complementary kings and queens.[2] In what manner and way this happens I have as yet been unable to discover.

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[1] In the nymphs of the first form of the *Termes*, in the nymphs of the *Calotermes*, in the winged forms and the true royal couples of both species the protozoa are found in small quantities.

## REVIEW OF THE FORMS BELONGING TO THE TERMITE COLONY.

### Termes lucifugus.

1. Youngest larvae.

- 2. Larvae unfit for reproduction.
  - 5. Larvae of soldiers.
    - 7. Soldiers.
  - 6. Larvae of workers.
    - 8. Workers.
- 3. Larvae fit for reproduction.
  - 9. Nymphs of 1st form.
    - 12. Winged forms.
      - 14. True royal pairs.
  - 10. Nymphs of 2d form.
    - 13. Supplementary royal pairs. ?
  - 11. Supplementary royal pairs. 2.
    - 15. Complementary royal pairs.
- 4. Supplementary royal pairs. 1.

CALOTERMES FLAVICOLLIS.

1. Youngest larvae.

2. Larvae unfit for reproduction. 3. Larvae fit for reproduction. Supplementary royal pairs. 3.

5. Soldiers. 6. Nymphs. 7. Supplementary royal pairs. 4.

8. Winged forms. 9. Supplementary royal pairs. 5.

10. True royal pairs.

1. Found only when No. 14, 15 and 11 fail, or the last two present in insufficient numbers.
2. " " " " 14, 15 and 4 " " " " " represented in insufficient numbers.
3. " " " " 10, 7 and 9 fail.
4. " " " " 10, 9 and 4 fail.
5. " " " " 10, 7 and 4 fail.

# NOTES ON ASILIDAE.

BY S. W. WILLISTON, NEW HAVEN, CONN.

In the preparation, some time ago, of a catalogue of the South American *asilidae*, and a partial study of a Brazilian collection, I made a number of notes, some of which seem of sufficient interest to publish. The catalogue includes no less than five hundred and forty names, not counting known synonyms, located under seventy-seven genera. The determination of species from among some of these is a dreary task, and in such genera as *Erax*, with its seventy-six "species," or *Mallophora*, with fifty-six, almost impossible, save by the aid of large collections. Undoubtedly there are many synonyms among the names, yet enough must remain to demonstrate the richness of the South American fauna in this family.

In a comparison of the generic names I have found several preoccupied, for which I would propose the following: For *Laparus* Loew, non Billberg, NEOLAPARUS; for *Cylindrophora* Philippi, LYNCHIA, in honor of Enrique Lynch A.; for *Phoneus* Macquart, NEOPHONEUS; and, by the strict rights of priority, in which I fully believe, *Neomoctherus* O. S. must give place to HELIGMONEURA Bigot, and *Andrenosoma* Rondani to NUSA Walker.

It is very singular that Schiner, with his entomological acuteness should have so misunderstood the genus *Senobasis* Macquart, as he seems to have done. Macquart's characters were as follows: "Charactères génériques des Dasypogons. Troisième article des antennes à base très menues et extrémité fort renflée et ovale. Abdomen à base rétrécie; armature copulatrice ♂ à pièces latérales en forme de crochets allongés. Cuisses nues. Ailes: quartrième cellule postérieure fermée, à nervure terminale arrondie." In his figures of *S. analis*

he adds a short style to the antennae, of which he says nothing in the description, and which does not in reality exist. Now this peculiar structure of the antennae was what Schiner emphasized as the characteristic of *Lochites*. The narrowing of the base of the abdomen in Macquart's *analis* is slight, and but little more than occurs in some of Schiner's species. Not only are the genera the same, but I am not sure but that some of Macquart's and Schiner's species may be. Several species that I have examined convince me that the narrowing of the abdomen at the base is a very trivial character. Schiner referred to *Senobasis* the species of *Blepharepium*, with an elliptical third antennal joint, forms totally different. Bigot seems equally to have misunderstood the genus, which perhaps is not strange. *Lochites* must therefore be dropped, which is all the more necessary from the fact that the name was twice used before Schiner's. I leave to the purist the emendation of the name *Senobasis*.

The species from North America referred by me to *Aphamartania* Schiner, does not belong there, as true specimens of the genus prove; where it does belong I do not know.

In the collection are specimens of a *Deromyia* closely resembling *D. misellus* from North America, with the fourth posterior cell closed. Baron Osten Sacken (Biol. Centr. Amer. 173) refuses to accept the identity of *Diogmites* and *Deromyia*, or, accepting it, would place the latter as a synonym or subgenus of the former. I cannot agree with him. Philippi's description was as good as Loew's and a year earlier. I can see no reason whatever for rejecting Philippi's name, and, until further evidence from Philippi's type species is at hand, the name *Diogmites* should be dropped.

Schiner located the genus *Pseudorus* Walker under the *dasypogoninae*, and attributed to it three submarginal cells, expressly stating that he had examined two specimens. A specimen that I have examined, and which I believe to be *P. piceus* Walker, has the marginal cell closed and with but two submarginal cells, agreeing in both respects with *P. bicolor* Bellardi. The genus is closely allied to *Doryclus* Jaenn.

Mr. Roeder has recently (Berl. ent. zeit. v. 21, 76) fully discussed the synonymy of *Doryclus* and *Megapoda* Macq., distinguishing them as genera, and clearing up the confusion of the species. Specimens of the two type species, *Doryclus distendens* (Wied.) Jaenn. and *Megapoda labiata* (Fabr.) Macq., convince me that he is quite right in separating the forms. Not only the characters of the legs, but the general habitus also, and the form of the face, are fully sufficient, in my opinion, to distinguish them. *Pseudorus* exists with less right than does *Doryclus* it seems to me. There is considerable variation in the three specimens I have examined, both male and female, of *D. distendens*, so that I am not prepared to say that the specific synonymy is correctly given by Roeder, but it

seems extremely probable.

Both Lynch and Osten Sacken have commented upon the difficulty of identifying the described species of *Atomosia*, and I can agree with them. There seem to be numerous structural characters that have been but little used, either for generic or specific discrimination. As a contribution to the better definition of the *Atomosia* group of genera, I offer the following:

A.—Third joint of the antennae longer than the first two together, without style; eyes on the side of the front emarginate, the front not widened above; scutellum with bristles; first posterior: cell usually narrowed; body punctulate.
*Atomosia* Macq.

"Third antennal joint longer than the first two together, without distinct style [front?]; scutellum without bristles. Hind femora with spinous bristles; hind tibiae feebly ciliate within. Body punctulate."
*Rhathimomyia* Lynch.

"Third antennal joint longer than the first two together, without distinct style [Front broad above?]. Abdomen much constricted at base, not strongly punctulate; wings and legs long."
*Eumecosoma* Schiner.

"Third antennal joint at least three times as long as the first two joints together, without style. Large species." [Front? punctulation?]
*Aphestia* Schiner.

Third joint of antennae longer than the first two together, with a terminal style; eyes not, or but very slightly emarginate on the sides of the front, the front much wider above; scutellum without bristles, or with hair-like ones. *Atonia*, gen. nov.

First joint of antennae about as long as the third, the latter without terminal style. Front much widened above, the eyes disciform and with enlarged facets in front; scutellum with weak bristles; body punctulate.
*Cerotainia* Schiner.

First joint of antennae as long as the third, without style. Scutellum without bristles. Abdomen punctulate, slender. Thorax remarkably projecting forward in a hemispherical, constricted eminence. *Cyphotomyia*, gen. nov.

Third joint of the antennae longer than the first two together, without style; front wide above; scutellum with fine bristles; seven abdominal segments visible in the male from above; abdomen smooth, not punctulate.
*Lamprozona* Loew.

The genus *Atonia* is, I believe, well founded, and will include a number of species, such as *A. ancylocera* Schiner, *A. mikii* Williston, etc. *Cyphotomyia* is perhaps more doubtful, but the entire absence of bristles on the scutellum, and apparently also on the ocelligerous tubercle, together with the remarkable development of the thorax, will, I believe, justify its erection. The species

upon which it is based I do not find anywhere described, and so give it here.

*Cyphotomyia lynchii*, sp. nov.

Antennae black, long (about as long as the hind femora); first joint about as long as the third, with hairs above, and a few bristles below; second joint short, with bristles; third joint slender, pointed, without style, black pubescent. Face and front densely yellowish gray pubescent; face a little wider above, very slightly projecting below, with a few fine black bristles on the lower part. Front very deeply excavated, and very broad above, the inner margins of the eyes convex, the ocelligerous tubercle small and (in the single specimen) without bristles. Head nearly twice as wide as high, flat, the eyes disciform, and with distinctly enlarged facets in front. Proboscis not long, truncate, black. Thorax black, punctulate; mesonotum remarkably projecting above in front, forming a hemispherical protuberance, laterally constricted at its base. Abdomen black, slender, acuminate, strongly punctulate, the segments without lateral bristles. Femora black, tibiae and tarsi yellow, except that the tips of the four anterior tibiae, the distal part of the hind pair, and the last two or three joints of all the tarsi, are brown or blackish; tibiae and tarsi with slender yellow bristles; hind tibiae on the inner side with yellow pile as in most species of *Cerotainia* and *Atomosia*. Wings lightly infuscate (from the microscopic pubescence); petiole of marginal cell long; first and second posterior cells of nearly equal width distally, long; veins at outer end of the discal and fourth posterior cells nearly in the same straight line; small cross-vein before the middle of discal cell. Length 5 mm.

One specimen, Chapada (near Cuyabá) Brazil, H. H. Smith.

Schiner long ago (Verh. zool.-bot. Gesellsch, 16,664) called attention to the artificial position of *Atractia* among the *asilinae*, sensu auctorum. I can only reiterate it, and protest against any classification that separates the genus from the immediate neighborhood of *Atomosia*, sensu strictiori. Indeed, as Schiner says, when the third antennal joint in any specimen is wanting, the species will be unhesitatingly referred to that genus. To separate *Atractia*, then, into another subfamily on the slight difference between a slender style (as in *Atonia mikii* Will.) and a short bristle, is absurd. *Atractia*, at present, includes but four species, three from South America, and one from Central America. Two additional species are represented in the Smith collection. Another species, of much larger size, and different appearance, also new, but more nearly related to some of the described species, has the abdomen entirely smooth, without punctulation, the proboscis longer, etc.; it may require the erection of a new genus for its reception. As in many of the species of the *Atomosia* group of genera, all these species have a minute projection on the upper border of the third antennal joint.

In the Ann. ent. soc. France, 1889,

p. 183 Bull., Bigot, in his characteristic way, proposes a new generic name, *Pseudarchilestes*, for *Dasypogon albitarsis* Macquart. The author could have hardly comprised more errors in one short note than he has done. First, Schiner first described the genus *Archilestes* (*Archilestris*) in the Verh. zool.-bot. gesellsch. 1866, v. 16, p. 672, and *not* in Reise der österreichischen fregatte Novara, which appeared two years later. Second, he says nothing about *D. magnificus* Walker, being the same as *D. albitarsis*, but, on the contrary, places *D. albitarsis* as a synonym of *D. capnopterus* Wied. (*op. cit.*, v. 16, p. 703; v. 17, p. 377), the type of the genus. Had Bigot been at all familiar with what Schiner has written, he would have observed that Schiner says expressly (Verh. zool.-bot. gesellch. v. 17, p. 378) that the third antennal joint in *A. capnopterus* is "*auf der Oberseite behaart*," the very identical character that Bigot assumes as distinctive of his *Pseudarchilestes*! Furthermore, Schiner says nothing in his original generic description about the third joint not being hairy above. That he does say so in a later description was undoubtedly an oversight, that should not have been accepted so heedlessly. In a word, Bigot erects a new genus upon the type species of another genus, based upon a character that was expressly stated to be present in that type. *Archilestris magnificus* Walk. has, likewise, the "third joint of the antennae distinctly beset with hairs on the upper side." (Osten Sacken, Biol. Cent.-Amer., p. 169.)

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I wish to substitute *Myiothera* for *Lynchia*, p. 255, as I find the latter was used by Weyenbergh in 1881.

## NOTES ON THE EARLY STAGES OF SOME HETEROCERA.

BY CAROLINE G. SOULE AND IDA M. ELIOT.

PANOPODA RUFIMARGO, VAR. ROSEICOSTA, Guen.

This larva was .28 mm. long, bright green, and found feeding on oak in Nonquitt, Mass., on 10 September, 1889.

The head was large, bright green, minutely speckled with black, and having a horizontal yellow line across the "forehead."

The body was bright, rich green, minutely speckled with black, and having subdorsal lines of bright yellow extending from the head to the end of the anal props.

On the first segment were four small yellow dots just behind the head, and two larger ones behind the four.

On the first and second segments were a faint yellow horizontal line, and three rough yellow tubercles.

There was a dorsal line of yellow dashes and the space on each side was

dotted with yellow, the dots becoming more numerous after the fifth segment.

There were nine obliques of clear yellow, their "trend" being the reverse of those of *Sphinx* larvae.

The feet and props were pale green with reddish tips, except the anal props, which were long, thin, and like the body in color.

All the props ended in curved and speading tips. The last moult was like the one before it, and occurred one week before the larvae spun leaves together for pupation. The pupa formed in five days from the spinning and was of a light brown color with no noticeable peculiarity. The moth emerged in June, 1889, and was kindly identified by Mr. John B. Smith.

CALLOSAMIA ANGULIFERA Walk.

These eggs were sent us by Miss Emily L. Morton, with no date of laying, but the egg-period is probably about that of *C. promethea*.

The eggs closely resembled those of *C. promethea*, but were whiter.

Many of the eggs turned lead color by July 20, but a few became green, and a few yellow. All hatched on 20 July.

The young larvae were 4 mm. long, and bright yellow with a dark head. The head had two light bands across it. There was a black transverse band on the top of the second segment. The anal segment had two dark transverse lines, and a dark line showed faintly between the segments.

The feet were grayish yellow with dark tips. Props yellow. Each segment had six warts and spines, except the first and last which had four.

27 July. First moult. Head yellow with a dark line and dark patch across it.

Each segment had two transverse black lines on dorsum. Body-color greenish yellow. On the first segment were four black warts with black spines. On the eleventh segment were three warts, the middle and largest one being on the dorsal line, and two warts just behind these. On each of the other segments were six yellow warts with yellow, black-tipped spines. Anal shield with a transverse line and patch of black. Feet and props pale yellow.

31 July. Second moult. Head pale green with dark mouth-parts.

Body whitish green, with two indistinct black lines on each segment, and a transverse row of yellow warts, each having a spreading crown of yellow spines. Just behind the head the row of warts was followed by a heavy black line.

Feet and props whitish green. Anal shield with a black line and patch.

6 Aug. Third moult. Head green, with black dots over the top and a black line across the face just above the mouth-parts.

Body very white-green, smooth, tapering from third segment to the anus.

From the third segment to the anal shield, there was a thick wavy ridge just below the spiracles. This ridge is one of the differences between these larvae and those of *promethea*. It

has been very noticeable in all the *angulifera*-larvae we have seen.

First segment. Two small yellow tubercles over the head, then on each side, two black, raised dots, and one just above the foot.

Second and third segments. Two large tubercles on the dorsum, black at base, ringed with yellow, orange at tips, smooth; two black points on each side, and one over the foot.

Two other segments, to the eleventh had, each, six black, raised points.

Eleventh segment. One large dorsal tubercle, of clear yellow ringed with black, and two black points on each side.

Twelfth segment. Four black points and two black tubercles on the anal shield. Anal shield and props edged with yellow, the props having a "horseshoe" of black on the outer side. Stigmatal ridge conspicuous. Feet and props whitish green.

12 August. Fourth moult. As before, but larger, and having tubercles of a bright coral red, instead of orange. These tubercles were ringed with yellow, and were black at base. The black "horseshoe" on anal props became a triangle of black, and each abdominal prop had a black dot on the outer side.

The yellow-white, stigmatal ridge, extending from third segment to anal shield, was very noticeable.

Spiracles inconspicuous.

23 August. Began to spin. Just before spinning the larvae measured nearly 75 mm. in length, and 44 mm. around the largest part of the body.

The dots and tubercles were small in proportion to the size of the larvae, and less conspicuous than those of *promethea* larvae. The tubercles were not erect like those of *promethea* larvae, and were ringed with yellow,—a marking which we have never found on *promethea.* The body was cream-colored above and somewhat greener on the venter, the yellow, stigmatal ridge, making a definite scalloped edge, ending in the anal flap.

The head was small in proportion.

The tubercles, the stigmatal ridge, and the smoother, *creamier* color form the most marked differences between *promethea* and *angulifera* larvae, which still closely resemble each other.

We have never seen an *angulifera* larva which would eat anything but the leaves of tulip-tree (*Liriodendron tulipifera*), while *promothea* larvae will eat almost any leaf!

The cocoons of *angulifera* were rounder, and in no case did the larva spin threads around the leaf-stem, or fasten the stem to the twig, while the *promethea* larva did this in every box where twigs were provided.

We feel that the two kinds are distinct and separate, although we have some *promethea* ♀ moths which are very near *angulifera* in their markings. The ♂ *angulifera* varies more from the ♂ *promethea* than the ♀ from ♀ *promethea*, although, in typical speci mens, the difference is very marked.

### Pheosia rimosa Pack.

Eggs, found on a poplar leaf, Nonquitt, Mass., 28 August, 1888. They

were white, opaque, hemispherical, and suggested eggs of butterflies, though they were smooth.

2 September. They hatched. Young larva 3 mm. long. Head, feet and props shining black.

Body whitish-green, with a subdorsal row of black spots, two to each segment; lateral row one to each segment.

Eleventh segment, a black dorsal tubercle.

First segment had a raised black patch, and looked swollen.

Second and third segments, two large black dorsal spots. Anal end black. Sparse hairs all over the body.

7 September. First moult. 19 mm. long. Head black above, and brown on face. Feet and props black.

Body green with slight yellow striations, and a black horn on the eleventh segment.

10 September. Second moult. 28 mm. long.

Head paler than the body, which was of a greenish-purple color, with the venter green, and a dorsal line somewhat darker than the body. Spiracles, conspicuous for the first time, black dots encircled with white.

14 September. Third moult. 38 mm. long. Head and body slate-gray, very smooth and shining. Anal shield rough, and the whole segment with a reddish tinge.

Caudal horn black, and from its base two black lines extended to the last spiracles.

Feet and props like body. Spiracles as before.

22 September the first one pupated.

Pupa, 25 mm., or slightly shorter, brown, smooth, slender.

First imago emerged 6 June, 1889.

### ICHTHYURA INCLUSA, Hubn.

At Nonquitt, Mass., 12 July, 1888, we found on a poplar leaf, and almost covering it, a close mat of tiny eggs of the color and *bloom* of Delaware grapes. 30 July these hatched, giving larvae of a grayish color, with black heads, with stiff hairs, which, when the larvae were in motion, made them look as if they had props on each segment. There were black dots on each segment, and these were confluent on the first segment, making a black collar. Anal props were black.

The larvae were very restless, and ate only the pulp of the leaves. They grew greenish in a day or two.

8 August. They moulted. Head black, body green, with a few scattered hairs; collar black as before.

Fourth segment had a black dot on the back, as had the anal segment.

There were rows of black dots, lateral and sublateral, with black "speckles" between.

15 August. Second moult. Head black. Body yellow with sparse white hairs. On fourth and anal segments a black wart.

Dorsal and subdorsal longitudinal black stripes meeting at the black anal wart. A wider sublateral black stripe made of confluent dots; and a subventral black stripe. On these two stripes were black warts, one on each segment, and from these warts arose the white

hairs. Feet black. Props yellow, with black dots.

19 August. Third moult. Head and body color as before. Dorsal stripes and warts as before. Sublateral and subventral stripes dark gray with black lines through them, and with warts as before.

On the first and second segments two additional warts, making six on those segments and four on the others.

Feet black. Props yellow with black dots. Spiracles black. Soft, fine hairs all over.

2 September. Fourth moult. 44 mm. long, slightly hairy.

Head black, with white hairs scattered over it.

Body almost black with four dorsal lines of bright yellow; one bright, and several indistinct, lateral lines, and marks of yellowish.

On fourth segment a bifid black tubercle, giving rise to white hairs. On anal segment a smaller black tubercle. Subventral surface with considerable yellow.

Feet and anal shield black. Props yellowish-brown.

28 August. The larvae began to spin, either loose cocoons in corners of the tin, or inside leaves drawn together.

Pupa, 15 mm. long, of a bright chestnut brown color. First imago emerged

### Spilosoma congrua, Walk.

At Nonquitt, Mass., 7 June, 1889, we found a nest of small, opaque, white, globular eggs on a leaf of *Trifolium agrarium*. These eggs were exactly like some received the same day from Miss Morton, and laid by a ♀ *Spilosoma congrua*. We found several moths of *S. congrua*, flying in Nonquitt this year.

We watched the larvae through all their moults, comparing the two sets daily, and they proved the same throughout.

The eggs turned lead-colored the day before they hatched. They hatched 9 June. The young larvae were 4 mm. long, with black heads.

Body yellowish, with dark warts, from which sprung gray or black hairs. Anal shield dark. Feet and props like body.

They ate clover, but much preferred plantain even to the *Trifolium agrarium* on which the eggs were laid.

When touched they curled up and dropped from the leaf, like the other "woolly bears."

14 June. First moult. 6 mm. long. Head black. Body-color yellow, with black transverse dorsal lines between the segments; third and tenth segments darker in color. Feet and props like body. Warts dark, with sparse blackish or dark gray hairs.

17 June. The black transverse lines disappeared and the color on and around the warts was deep brownish-yellow.

18 June. Second moult. Head black. Body color deeper and browner yellow; warts darker, with hairs longer and more numerous.

22 June. Third moult. 15 mm.

long. Head and feet black. Body-color darker and browner than before, with a dorsal white line, and lateral orange line, broken between the segments.

Warts *shiny* black, with short very black hairs, growing in tufts.

27 June. Fourth moult. 21 mm. long. As before, only bigger and blacker, and with the hairs longer. Orange laterals deeper and brighter.

They move very rapidly with a quick, jerky motion, stopping suddenly when at the fastest speed.

4 July. Fifth moult. As before, only larger, and with denser hairs.

10 July. They were from 25 mm. to 29 mm. in length. Most of them were very active and voracious. If left without food for even a short time they would eat such of their number as were preparing to spin, and were therefore less vigorous than the rest!

11 July. Began spinning. Unless the cocoons of the earlier spinners were removed the pupae would be found half devoured by the larvae not yet ready to spin, even when there was plenty of food plant in the boxes.

The cocoons were oval, thin, with hairs spun into them. Pupa of bright chestnut color, short, stout.

CRESSONIA JUGLANDIS, A. & S.

Eggs, ovoid, pale green, laid about 7 July. They hatched 17 July; having grown yellow the day before.

Young larva, 9 mm. long, pale yellow, with short, yellow caudal horn; feet and props concolorous with body. Anal props extended, in trailing points, beyond the anal shield.

They ate walnut.

21 July. First moult. 15 mm. long, slightly rough. Head green, with a long, conspicuous point on the apex.

Body, feet, props, and caudal horn green.

The body had a longitudinal white line on each side of the dorsal line, extending from head to horn.

The larvae drank greedily. In two days the caudal horn grew brownish, and faint yellow obliques appeared.

27 July. Second moult. Head green, with two long brownish filamentous points at apex. From these points a brownish line extended down the back of the head. The head was granulated with yellowish-white points, and had yellow face-lines.

Body green, granulated with yellow-white, and having yellow obliques and subdorsal lines.

Feet and props green, the anal props having the trailing points as before.

Caudal horn brownish and granulated.

1 August. Third moult. Head green, very pointed, with white face-lines, and very bifid apex.

Body green, and, as well as the head and horn, thickly granulated with yellow white points. Horn long and usually held level with the body. Anal shield had two largish white tubercles.

8 August. Fourth moult. Head less pointed, though still shaped like an apple-seed.

Body as before. Anal shield bisected

by a vertical black line on each side of which was a white wart.

The long points on the head were replaced by reddish granules.

Spiracles red

The effect of the body was like the rough underside of the walnut leaves.

15 August. The white granules had become encircled by purplish brown lines, the lines being broader around the granules forming the obliques. The body was largest at the anal segment, and tapered rapidly to the head.

29 August. Stopped eating, being about 75 mm. long.

7 September. Pupated. As our specimens failed to cast the larval skin, the pupae were not sufficiently perfect to describe. We therefore quote Prof. Fernald's description, in his "Sphingidae of New England."

"The pupa is blackish brown, and roughened over the entire surface. There are four little prominences on the head case, and the terminal segments are flattened on the ventral surface, and have lateral, toothed appendages."

Our larvae did not correspond exactly with Prof. Fernald's description.

### Paonias astylus, Drury.

On 7 July, 1889, a ♀ *astylus* emerged from a pupa formed by a larva found in the previous September. The moth was fastened outdoors the next night, but no ♂ was seen.

On 9 July she laid about sixty eggs. These were ovoid, and apple-green in color.

19 July. They turned yellow with an opaque green line, and the red caudal horn could be clearly seen.

20 July. The young larvae came out, eating only enough shell to allow them to pass, and crawling for hours with the iridescent shell still over the caudal horn.

Newly hatched larva. Head, green, round, with dark mouth-parts and a dark dot close to the palpi, on each side.

Body, pale green, granulated, with slight indications of yellow subdorsal lines from the head to the caudal horn. Caudal horn short, stout, rough, red at base, yellow in the middle, very dark red at tip, which was markedly bifid.

Feet and props green.

Ate *Vaccinium corymbosum*, and, afterward, *Gaylussacia frondosa*.

29 July. First moult. As before, except that the head was more pointed, the horizontal yellow lines were clearer, and the feet were red.

4 August. Second moult. As before, only larger, being 19 mm. long.

12 August. Third moult. Head pointed, bright green, granulated.

Body bright green, granulated with yellow white. Red dots and patches began to appear, set irregularly between the dorsal and subdorsal lines.

Faint yellow obliques appeared. Caudal horn short, stout, inclined forward, yellow around the base, then red, then yellow in the middle, and deep red at tip. It was granulated with rough tubercles most noticeable at the tip, which was formed by two pointed tubercles with a slightly smaller one between them.

These tubercles gave a very different effect from the bifid tips of the earlier stages, and, without a lens, the horn looked blunt at the tip.

Feet and props red-tipped.

21 August. Fourth moult. Head less pointed, color as before.

Body green, less roughly granulated with yellow.

Yellow obliques clearer. Yellow horizontal lines confined to the first three segments; and faint sublateral lines of yellow dots appeared on these segments.

The red dots and patches were more numerous, and of a clear, bright red. Four red dots appeared on the anal shield.

Feet and props red-tipped.

Spiracles, heretofore unnoticeable, were bright red. Caudal horn short, stout, very erect, green at base, then red, ringed with yellow in the middle, and tipped with deeper red, though not as dark as in the earlier stages.

The "bifid tip" was reduced to an ordinary tip ending in two small granules, not seen without a lens.

29 August. The red patches were larger and more numerous. In one specimen they filled the dorsal spaces between the obliques on the segments fourth to tenth inclusive. This specimen had a substigmatal row of red dots, wanting in the others. The caudal horn was less bright in color, and very short in proportion to the size of the larvae, which was now about 63 mm. long.

Mr. Peck, quoted by Mr. John B. Smith in his "Monograph of the *Sphingidae*," states that the "bifid tip" of the caudal horn or "these spines" forming the "bifid tip" "are constant from its hatching," but in no specimen which we have seen has this been the case. Nor have the colors of the horn been such as he describes them. Instead of a brownish or red-brown, the color has been, in every instance, a clear, bright red, matching the leaves of the high huckleberry and blueberry when "turning" in the autumn. In fact, the whole larva, when full grown, had the exact colors of these leaves, and the horn looked like the buds "set" for the following spring!

The larvae were very delicate, many dying in moulting, and those found were very subject to parasites.

5 September. Stopped eating and prepared for pupation.

8 September. Pupated.

Pupa of a rich chestnut brown color, with a sharp point on anal end.

31 mm. long, neither slender nor stout.

PAONIAS MYOPS, A. & S.

Eggs roundish, green, laid 9 June and hatched 24 June.

Young larvae, pale yellow-green with pointed heads. Ate wild cherry.

30 June. First moult. Head green, pointed at apex. Body green, feet, props and horn concolorous with body.

3 July. Faint yellow oblique, and a horizontal yellow line on the first three segments appeared, also indistinct red spots.

5 July. Second moult. 19 mm.

long. Head green and very pointed, ending in a yellow dot at apex.

Body green, with, on each side, a yellow horizontal on first three segments, seven yellow obliques, each crossing two segments, and meeting its mate on the dorsal line. Red spots on dorsum and sides, irregularly placed, and varying in size, number, and position in the different larvae. Body thickly granulated with yellow dots.

Caudal horn short, red above and below, yellow on each side, from the last obliques.

Feet and props green, anal shield pointed.

14 July. Fourth moult. 31 mm. long. Head green, pointed, and with faint yellowish lines on each side.

Body green, with horizontal lines as before. Yellow obliques more distinct, the last ones being yellower and wider than the others, and reaching part way up the caudal horn.

Anal shield pointed, and edged with yellow. Caudal horn short, red above, green beneath, yellow at the sides.

Feet reddish, props green, spiracles yellow. In some specimens, the spiracles were set in small red patches.

The red spots varied very much in the different specimens, those on the fifth segments being most found.

In three specimens the red spots were surrounded by yellow.

In *all* the spots were of a clear, bright red, and not at all of the "brownish red" referred to by some writers.

The bodies were thickly granulated with yellow.

20 July. Stopped eating.

27 July. Pupated.

Pupa of a chestnut brown color, darker than that of *Dolba hylaeus*; smooth, neither slender nor stout, and about 31 mm. long.

### Dolba hylaeus, Drury.

A ♀, caught in Nonquitt, Mass., by a little girl, laid eggs between 6 and 15 August, the child did not notice the exact date.

The eggs were small, oval, pale green, becoming yellowish two days before hatching. They hatched on 17 August.

Young larva, 6 mm. long, pale green, with a caudal horn as long as the body. The horn was green at first, but grew black in two hours.

The larvae ate inkberry (*Prinos glabra*) but would not touch sweet fern.

They grew pinkish after eating, especially near the head and just before the caudal horn. Like most young sphingid larvae they spun silken threads as they moved about.

24 August. First moult. They became greener, and showed a faint white line on each side of the dorsum, extending from the head to the caudal horn. Feet and props concolorous. The horn was black, the segments around the base being whitish green. They ate their skins, except horn and mask, after each moult.

31 August. Second moult. Pale green, with a dark dorsal line, edged on each side with white, extending from head to horn.

Seven faint, yellow-white obliques could be seen on each side, the last being yellower and wider than the others, and extending half-way up the horn.

6 September. Third moult. 25 mm. in length. Head green, rounded. Body green, whiter on dorsum, with a deep green dorsal line. The white lines on each side of the dorsal line were hardly to be distinguished from the whitish dorsal surface.

There was a yellow, horizontal, lateral line, broken by the obliques, which were yellow edged in front with dark green.

The caudal obliques were yellower and broader than the others, and extended a little way up the horn. The horn was long, sharp, and rough, green at base, almost black elsewhere.

Feet and props green.

8 September. The body showed yellow granulations more dense on first three segments.

The yellow horizontal lines were confined to these three segments, and the last obliques grew whiter than the others, and were edged in front with blue-black.

The head was thickly granulated with blue-black. Feet red-brown at tips.

One specimen had the caudal horn of olive-green, very light at the tip.

11 September. Fourth moult. Head round, green, granulated.

Body green, granulated with yellow on the first three segments, venter, and the anal shield.

Dorsum very white-green, bisected by a deep green line from head to horn. Yellow horizontals gone.

Obliques whiter, edged in front with dark green and a trace of blue-black. Last obliques much whiter, with a definite edge of blue-black.

Spiracles, noticeable for the first time, —blue-black encircled with white.

Caudal horn green at base and sides, blackish green above, and lighter beneath; slightly rough, sharply pointed, slender and long.

Feet green at base, ringed with yellow, tipped with blue-black. Props green. Anal shield edged with yellow green.

17 September. Fifth moult. Head blue-green dotted with small, dark granules. Mouth-parts dark.

Body yellow green, with the dorsum very white-green. First three segments granulated with white and venter slightly so. Obliques bright pink shading into yellow on the dorsum, and edged in front with deep green. The last obliques had white in place of the yellow, and continued, as white granules, one-third the length of the caudal horn.

Horn blue-green above and beneath. Anal shield slightly edged with yellow.

Dorsal line very blue-green edged on each side with white.

Feet green, and ringed with yellow, and with blue-black tips. Length 38 mm.

In two days the dark green edges of the obliques and of the horn had become very purple-black, the purple showing most beneath the horn.

26 September. 56 mm. long. As

before, except that the yellow granules were very indistinct; and the obliques next the head could hardly be traced.

The other obliques were bright pink, edged with deep blue-purple. Caudal horn was green at base, and blue-purple elsewhere, the "blue-purple" being of the exact tint of very ripe inkberries. Horn short in propoition to size of the larvae.

The spiracles were dark in ovals of white, these ovals being encircled by faint blue-purple lines. They were small, and merged in the pink obliques on six segments, but conspicuous on the others.

2 October. Stopped eating, being then 63 mm. long.

10 October. Pupated.

The pupa was 31 mm. long, neither stout nor slender, with a tongue-case 9 mm. long, and lying close against the body. Its color was green at first, and showed the dark obliques on the abdominal segments, but in two days it became bright brown. There was a point on the anal end, but no hook.

# THE MALE ELEMENT THE ORIGINATING FACTOR IN THE DEVELOPMENT OF SPECIES.

BY JEROME MCNEILL, MOLINE, ILL.

Professor W. K. Brooks, in his study of the philosophy of heredity[1] has advanced a new theory which offers a reasonable explanation of the means by which ancestral characters may be preserved in any species and at the same time new variations transmitted to posterity. Without attempting to state the theory in full (this is the more unnecessary because it is probably known to a large majority of the readers of PSYCHE), it will be sufficient for the present purpose to say that the author considers that "the male element is the originating and the female the perpetuating factor in the evolution of species." Mr. Brooks offers no more convincing arguments in support of his views than the evidence from sexual characters, and while the illustrations drawn from entomology are probably the best that could be selected, it has seemed to the writer that it might not be uninteresting to note the application of the theory to the genera and species of as little known and little studied an order as that of orthoptera. In presenting this evidence I shall collocate it with the five propositions formulated by Mr. Brooks.

1. "In most animals of separate sexes, the males of allied species differ

1 The law of heredity, by W. K. Brooks, Associate on biology at Johns Hopkins university. Published by John Murphy and co., Baltimore.

more than the females from the ancestral type."

In the first place, assuming that the larvae and pupae are more like the ancestral forms than the imago, the females show less divergence from this form than the males in being more frequently apterous or abortive winged. When the wings are fully developed they are as a rule smaller relatively if not absolutely in the female, and there is perhaps no notable exception to this rule. The females also approach more nearly to the ancestral type in the frequently less developed antennae.

Throughout the order it is very generally true that the coloration is brighter and more contrasting in the male. In *Pezotettix viridulus* the male is bright pea green (in living specimens) with black pleural stripes while in the female the color is nearly uniformly dull brown. In the wings of most *oedipodae* the transverse black or fuliginous band is more extended in the male as are also the similarly colored spots in the usually transparent apex. In the same family the fuscous spots and bands of the elytra are not infrequently much deeper in color in the male. The genus *Acridium* offers some exception to this rule of coloration since, while on the whole the males are more brilliantly colored, certain species have the elytra as well as the head and pronotum obsoletely spotted or unicolored in the male, and obsoletely or distinctly spotted in the female, the latter being much more variable in this respect. This apparent departure from the rule may possibly be explained by the females retaining longer a larval or ancestral character. Unfortunately I have no knowledge of the larvae of these species to help me in deciding this point. But in the allied genus *Melanoplus* it is certain that the larvae are in many species much more spotted and streaked than the imagos. In *mantidae* generally the males have the elytra distinctly more membranous than the females. Since the elytra are, in orthoptera generally, protective in color and form as well as in structure, it might be expected that the only carnivorous family needing this protection least would be the first to outgrow it and it is quite in accord with Mr. Brooks's theory of heredity to find the males of *mantidae* leading the females in this change. In the genus *Melanoplus* the males show in the club-shaped abdomen a marked departure from the usual subcylindrical or tapering form of this part which is common in the saltatorial division of the order. The males of this genus and its allies *Pezotettix* and *Acridium* exhibit a peculiar development of the anal cerci which are generally of the simplest and most regular form in this family.

Finally the much more attenuate forms of the males of *phasmidae* certainly show them to be in advance of the stouter females in their divergence from the typical orthopterous form.

2. "Those organs that are confined to males or are of more importance or are more perfectly developed in them than in the females are much more likely to give rise to hereditary modifi-

cations than parts which are confined to or are more perfectly developed in females."

On this point it will be sufficient to call to mind that the organ which is almost entirely restricted to the males of *locustidae*, *gryllidae*, and *acrididae* is the musical apparatus. In *acrididae* this apparatus is too little specialized to repay examination. In *locustidae* and *gryllidae* there is little evidence to be found of an unmistakable character, but the last mentioned family has one genus *Oecanthus* and the first mentioned two genera *Conocephalus* and *Orchelimum* which throw some light on the subject. Concerning *Oecanthus* I may say that the three most common species are *niveus*, De Geer, *angustipennis*, Fitch, and *fasciatus* Fitch. These species are usually considered to be mere varieties, and although I am satisfied that the distinctions of form and habits and to a less degree of color entitle them to rank as species, their very distinct "songs" leave scarcely any room for doubt. Of course this difference in the character of stridulation is accompanied by a certain, though not conspicuous, difference in the structure of the stridulating apparatus, and by its tending to vary in structure and use, it aids greatly in establishing two species. In *Conocephalus* and *Orchelimum* the evidence is similar. The species for the most part are very similar and the most certain means of distinguishing them is in their songs.

3. "That a part which is confined to or is most developed in males is more likely than a similar female part to vary."

This principle is well illustrated in the anal cerci of the males of *Melanoplus*, *Pezotettix*, and *Acridium*.

This part which has been before remarked in the females is simple and constant in form, in the males is extremely variable in size and shape, so that in the two genera first mentioned, at least, it furnishes the best specific characters for distinguishing the species. In these genera also the males furnish good specific characters in the form of the last ventral segment, while in the female this part is very constant in form

4. "That males are, as a rule — more variable than females."

Much of the evidence already given bears upon this point — and I will content myself with a very few more examples.

The males of two species of *Tridactylus*, *T. apicalis* Say and *T. terminalis* Uhler have the anterior tibiae furnished with a very remarkable appendage.

The tibiae are divided into two forks nearly at right angles to each other. That fork which occupies the usual position of the tibiae ends in two strong spines. From its base the true tibia extends backward parallel with the thigh, with which it forms a raptorial apparatus. This brand ends in a strong curved claw — and a very diminutive tarsus which is placed at right angles to the tibiae. In these species the males are further distinguished from the females by the swollen pronotum.

In the genera *Centhophilus* and

*Udeopsylla* the males are very generally distinguished by the larger and more numerous spines on the lower margin of the posterior femora.

5. "That the male leads and the female follows in the evolution of new races."

Little remains to be said on this point since nearly all that has gone before shows already that in *orthoptera* male characters lead in the recognition if not in the evolution of new species. No student of orthoptera will question the statement that were it not for the variation of the cerci and the last ventral segments of the males of *Melanoplus* and *Pezotettix* it would not be possible to recognize nearly so many species in these genera as are now known to exist. It is also indisputable that in *Melanoplus* especially in several instances, it is practically impossible to distinguish with certainty between the females of closely allied species. Examples are not wanting of cases in which the males differ so greatly from the females, that they have been placed when first described in different genera. The male of *Chloealtis conspersa* Harr., differs so much from the female that Mr. Scudder in his ignorance of their relationship was quite justified in describing the male as *Stenobothrus melanopleurus*. The males of *Syrbula admirabilis* Uhler are of two forms; the green one, which is very rare, resembles the female in coloration but differs in structural characters, and especially in the clavate antennae. The dark form, in addition to the structural features which are very similar to those of the green form, is so very different in coloring that it was for a long time widely separated from the female, and as genera are now made, the sexes may be considered generically distinct.

It will be seen that orthoptera furnish strong, if not striking, corroborative evidence of the truth of Mr. Brooks's theory of heredity. While I do not pretend, in this hasty review, to have exhausted the illustrations that might be furnished by the species and families represented in the United States I have not found any controvertive evidence except the considerable variation in the length and shape of the ovipositor of *Xiphidium*, that of the closely allied genus *Orchelimum* being quite constant, and the less marked variation in the length of the same organ in *Conocephalus*, *Thyreonotus* and *Gryllus*.

# THE STRAWBERRY ROOT LOUSE (APHIS FORBESI N. S.)

BY CLARENCE MOORES WEED, COLUMBUS, OHIO.

[Partial reprint from Bull. Ohio agricultural experiment station, September 1889, v. 2. no. 6. p. 148-150.]

During the latter part of August Mr. S. R. Kramer, of Gahanna, Franklin county, Ohio, brought me specimens of a small louse infesting the roots of strawberry plants, which he reported to have ruined a plantation some two and a half acres in extent. An examination of the plants upon the station grounds showed that a large proportion of them were also infested by the same insect; and on inquiring of prominent horticulturists recently assembled at the state fair, I found that many of them were only too well acquainted with the pest, and that it is quite generally distributed over the state.

The insect proved to be a species of *Aphis*, to which attention was first called by Professor S. A. Forbes in the Thirteenth report of the state entomologist of Illinois (p. 102-103).

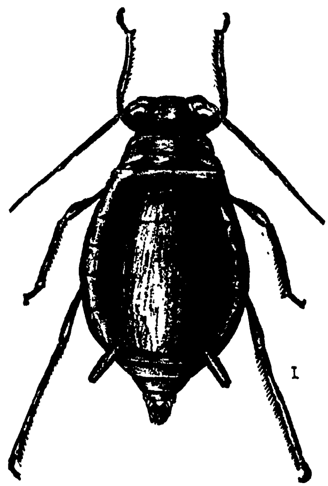
On the station plants the lice occur both upon the roots and lower portions of the crowns. In both situations they are carefully attended by the small brown ant (*Lasius alienus*) which mines about the roots, upon which it probably places the lice, and carries them away in its jaws upon the approach of danger —treating them in fact exactly as it treats the corn root louse (*Aphis maidis*) in corn fields. From the discovery of the deposition of the plant-lice eggs about the strawberry roots recorded by Professor Forbes, I surmise that the ants take care of them through the winter, in the same way that they have been found, by the author just mentioned, (Amer. nat., v. 21, p. 579) to care for the eggs of the corn root louse.

Mr. Kramer informs me that he first found these lice upon his plants about the middle of July, when they were very abundant.

A great many of the lice on the crowns and roots were infested with hymenopterous parasites.

## Description.

Although Professor Forbes published an accurate description and figure of this strawberry root louse, he did not give it a specific name, and consequently I have proposed that it be named



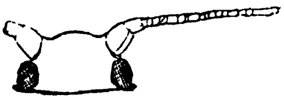
1

in honor of its discoverer, and called *forbesi*. The form now present on the roots is shown magnified at Fig. 1, and may be described as follows:

APTEROUS VIVIPAROUS FEMALE.

| | |
|---|---|
| Length . . . . | 1.0 mm. |
| Width . . . . | .4 mm. |

Body, small, ovate. Color, dark bluish-green: head, yellowish or greenish; antennae, yellowish-brown toward base, darker apically; eyes, reddish; legs, yellowish or yellowish-brown, ex-



cept the tibio-femoral articulations and tarsi, which are dusky; cornicles, yellowish or yellowish-brown at base, darker apically; cauda varying from bluish-green to yellowish or yellowish-brown. Antennae about half as long as body, roughened, as shown at Fig. 2, six-jointed[1]; joints I and II sub-equal in length, I being slightly broader than II; III long, slightly longer than IV plus V, but a little shorter than VI; IV about half as long as III; V short, two-thirds as long as IV; VI longest. Cornicles long, slightly tapering, flanged at tip. Cauda prominent, flattened, with a number of curved hairs along the margin. Prothorax with a blunt tubercle on each side.

Described from many living specimens taken on roots of strawberry plants, 7 September, 1889.

[1] Although I agree with Forbes and Lichtenstein that what is here called the sixth joint of the antenna is really the prolongation of the fifth, I follow the general practice of calling it distinct for sake of brevity and convenience.

## CLASSIFIED LIST OF FOOD PLANTS OF AMERICAN BUTTERFLIES, DRAWN FROM SCUDDER'S "BUTTERFLIES OF THE EASTERN UNITED STATES."

[Names followed by an * indicate the plants for which the species concerned have a decided preference. Those enclosed in parentheses are exceptional or doubtful.]

OENEIS SEMIDEA. *Cyperaceae*, Carex vulgaris var. hyperborea.

OENEIS JUTTA. *Cyperaceae*, Carex oligosperma;* *Gramineae*; (*Juncaceae*, Juncus articulatus).

CERCYONIS ALOPE. *Gramineae*.

CERCYONIS NEPHELE. *Gramineae*.

ENODIA PORTLANDIA. (*Urticaceae*, Celtis occidentalis); *Gramineae*.*

SATYRODES EURYDICE. *Cyperaceae*, Scirpus eriophorum, Carex bromoides; *Gramineae*.

NEONYMPHA PHOCION. *Gramineae*, Panicum sanguinale, Dactolytenium aegyptiacum.

CISSIA EURYTUS. *Leguminosae*, Trifolium; *Xyridaceae*, Xyris torta; *Gramineae*.*

CHLORIPPE CLYTON. *Rosaceae*, Prunus; *Aristolochiaceae*, Aristolochia; *Urticaceae*, Celtis occidentalis.*

BASILARCHIA ARCHIPPUS. *Rosaceae*, Prunus, Pirus, Chrysobalanus oblongifolius; *Salicaceae*,* Salix nigra, S. livida var. occidentalis, S. sericea, Populus balsamifera var. candicans, P. tremuloides, P. monilifera, P. dilatata.

BASILARCHIA ASTYANAX. *Rosaceae*,* Prunus, Pirus, Crataegus, Cydonia; *Grossulaceae*, Ribes; *Ericaceae*, Vaccinium stami-

neum; *Cupuliferae*, Carpinus americana, Quercus ilicifolia; *Salicaceae*, Salix, Populus.

BASILARCHIA ARTHEMIS. *Tiliaceae*, Tilia; *Rosaceae*, Crataegus, Amelanchier; *Caprifoliaceae; Urticaceae*, Ulmus; *Betulaceae*, Betula lenta;* *Salicaceae*, Populus balsamifera.

POLYGONIA INTERROGATIONIS. *Tiliaceae*, Tilia americana; *Urticaceae*, Ulmus americana,* Celtis occidentalis Urtica, Boehmeria cylindrica, Humulus lupulus.

POLYGONIA COMMA. (*Tiliaceae*, Tilia); *Grossulaceae*, Ribes; *Urticaceae*,* Humulus lupulus, Ulmus americana, Urtica, Boehmeria cylindrica.

POLYGONIA SATYRUS. *Ericaceae*. Azalea: *Urticaceae*,* Urtica.

POLYGONIA FAUNUS. *Grossulaceae*, Ribes; *Betulaceae*, Betula lenta;* *Salicaceae*, Salix humilis.

POLYGONIA GRACILIS. (Probably one of preceding or succeeding.)

POLYGONIA PROGNE. *Rosaceae*, Rubus; *Grossulaceae*,* Ribes rotundifolium, Ribesia; *Urticaceae*, Ulmus americana.

EUGONIA J-ALBUM. *Betulaceae*, Betula alba var. populifolia; (*Salicaceae*, Salix, Populus).

EUVANESSA ANTIOPA. *Rosaceae; Urticaceae*, Ulmus americana,* Celtis occidentalis; *Betulaceae*. Betula humilis; *Salicaceae*, Salix,* Populus candicans, P. dilatata.

In Europe: *Tiliaceae*, Tilia; *Betulaceae*, Betula humilis; *Salicaceae*, Salix.

AGLAIS MILBERTI. *Urticaceae*,* Urtica dioica, U. gracilis; (*Salicaceae*, Salix).

VANESSA ATALANTA. *Urticaceae*, Urtica,* Humulus lupulus, Boehmeria cylindrica, Parietaria debilis.

In Europe: *Urticaceae*, Urtica, Parietaria.

VANESSA HUNTERA. *Compositae*, Gnaphalium polycephalum,* G. purpureum,* Antennaria plantaginifolia,* Anaphalis margaritacea,* Helianthus, Senecio cineraria, Artemisia ludoviciana; *Borraginaceae*, Myosotis.

VANESSA CARDUI. *Malvaceae*, Althaea rosea; *Compositae*, Centaurea benedicta,* Cnicus lanceolatus,* C. arvenis,* Carduus nutans.* Silybum marianum, Onopordon acanthium, Arctium lappa, Senecio cineraria, Helianthus sp., Anaphalis margaritacea, Artemisia; *Borraginaceae*, Borrago officinalis; *Urticaceae*, Urtica.

In Europe: *Malvaceae*, Malva rotundifolia: *Compositae*, Carduus,* Cnicus,* Onopordon, Centaurea benedicta.* Cynara scolymas, Achillea millifolium, Gnaphalium arvense. Filago arvensis; *Borraginaceae*, Echium.

In Asia and Africa: *Compositae*, Artemisia, Blumea; *Malvaceae*,* Malva.

JUNONIA COENIA. *Onagraceae*, Ludwigia alternifolia; *Plantaginaceae*, Plantago lanceolata, P. virginica; *Scrophulariaceae*, Gerardia purpurea,* Linaria canadensis.

EUPTOIETA CLAUDIA. *Berberidaceae*, Podophyllum peltatum; *Violaceae*, Viola tricolor; *Portulacaceae*, Portulaca; *Leguminosae*, Desmodium paniculatum; *Passifloraceae*,* Passiflora incarnata, P. caerulea; *Grossulaceae*, Sedum;* *Borraginaceae*, Cynoglossum?

SPEYERIA IDALIA. *Violaceae*, Viola; (*Compositae*, Sericocarpus conyzoides).

ARGYNNIS CYBELE. *Violaceae*, Viola.

ARGYNNIS APHRODITE. *Violaceae*, Viola.

ARGYNNIS ATLANTIS. *Violaceae*, Viola.

BRENTHIS MYRINA. *Violaceae*.

BRENTHIS MONTINUS. (*Violaceae*; *Rosaceae*, Geum radiatum).

BRENTHIS BELLONA. *Violaceae*.

PHYCIODES THAROS. *Compositae*, Aster, A. novaeangliae,* (Actinomeris).

PHYCIODES BATESII. (*Compositae*).

CHARIDRYAS NYCTEIS. *Compositae*, Aster [Doellingeria] umbellatus, Rudbeckia laciniata, Helianthus divaricatus,* Actinomeris squarrosa,* Verbesina helianthoides.

CINCLIDIA HARRISII. *Compositae*, Aster [Doellingeria] umbellatus.

EUPHYDRYAS PHAETON. *Grossulaceae*, Ribesia; *Caprifoliaceae*, Lonicera ciliata,

Viburnum dentatum; *Plantaginaceae*, Plantago; *Scrophulariaceae*, Chelone glabra,* Mimulus ringens, Gerardia pedicularia.

ANOSIA PLEXIPPUS. *Apocynaceae*, Apocynum androsaemifolium; *Asclepiadaceae*, Asclepias cornuti,* A. purpurascens, A. incarnata, A. tuberosa, A. amplexicaulis, A. tomentosa, A. curassavica, A. nivea, Acerates.

HYPATUS BACHMANII. *Urticaceae*, Celtis occidentalis.

CALEPHELIS BOREALIS. Unknown.

STRYMON TITUS. *Rosaceae*, *Prunus*;* *Compositae*, Eupatorium coelestinum; *Cupuliferae*.

ERORA LAETA. Unknown.

INCISALIA NIPHON. *Leguminosae* (Lupinus perennis); *Coniferae*, Pinus,* (Juniperus).

INCISALIA IRUS. *Rosaceae*, Prunus;* *Leguminosae*, Lupinus perennis, Cercis canadensis; *Ericaceae*, Vaccinium corymbosum, Leucothoe racemosa, Cyrilla racemifolia; *Aquifoliaceae*, Ilex.

INCISALIA AUGUSTUS. Unknown.

URANOTES MELINUS. *Hypericaceae*, Hypericum; *Leguminosae*; *Rosaceae*, Crataegus coccinea, C. apiifolia; *Borraginaceae*, Cynoglossum officinale; *Urticaceae*, Humulus lupulus.*

MITURA DAMON. *Coniferae*, Juniperus virginiana;* *Smilaceae*, Smilax.

THECLA ONTARIO. Unknown.

THECLA LIPAROPS. *Rosaceae*,* Crataegus, Prunus, Amelanchier canadensis; *Ericaceae*, Vaccinium corymbosum; *Aquifoliaceae*, Ilex: *Cupuliferae*, Quercus, Castanea; *Salicaceae*, Salix.

THECLA CALANUS. (*Rosaceae*, Crataegus); *Juglandaceae*,* Juglans cinerea, Carya, C. glabra; *Cupuliferae*, Quercus rubra, Q. falcata.

THECLA EDWARDSII. *Cupuliferae*, Quercus.

THECLA ACADICA. *Salicaceae*, Salix.

EVERES COMYNTAS. *Leguminosae*, Lespedeza capitata, Phaseolus perennis, Desmodium marylandicum, Galactia, Trifolium.

CYANIRIS PSEUDARGIOLUS. *Ranunculaceae*, Cimicifuga racemosa;* *Cruciferae*, Rhus, (Nasturtium): *Rhamnaceae*, Ceanothus americanus, (Rhamnus carthartica); *Sapindaceae*. Aesculus californica; *Leguminosae*, Erythrina herbacea, Apios tuberosa, (Trifolium); *Rosaceae*. Spiraea salicifolia, (Amelanchier canadensis); *Cornaceae*, Cornus;* *Caprifoliaceae*, Viburnum acerifolium; *Compositae*, Verbesina helianthoides, Actinomeris squarrosa,* Dimorphantes mantchuricus; *Ericaceae*, Vaccinium, V. corymbosum; *Aquifoliaceae*, Ilex, (Begonia); (*Asclepiadaceae*, Asclepias; *Salicaceae*, Salix).

NOMIADES COUPERI. (*Leguminosae*, Vicia cracca.)

RUSTICUS SCUDDERII. (*Rhamnaceae*, Ceanothus); *Leguminosae*, Lupinus perennis.

CHRYSOPHANUS THOE. *Rutaceae*, Xanthoxylum; *Polygonaceae*, Polygonum, Rumex crispus.

EPIDEMIA EPIXANTHE. (*Gentianaceae*, Menyanthes trifoliata; *Polygoniaceae*, Persicaria, Rumex verticillatus; *Lauraceae*).

HEODES HYPOPHLAEAS. *Leguminosae*, Trifolium; *Polygoniaceae*, Rumex acetosella,* R. crispus.

FENISECA TARQUINIUS. Plant lice with clustering habit, especially *Schizoneura tessellata*.*

CALLIDRYAS EUBULE. *Leguminosae*, Cassia* marylandica, C. chamaecrista, C. occidentalis, C. tora, Trifolium.

XANTHIDIA NICIPPE. *Leguminosae*, Cassia* marylandica, C. occidentalis, C. tora, Trifolium.

EUREMA LISA. *Leguminosae*, Cassia chamaecrista,* C. occidentalis, C. nictitans, (Trifolium), Glycine.

EURYMUS INTERIOR. (*Leguminosae*, Desmodium; *Ericaceae*, Vaccinium).[1]

EURYMUS PHILODICE. *Leguminosae*, Trifolium* agrarium, T. repens, T. pratense, Baptisia tinctoria. Lupinus perennis, Medi-

[1] Mr. Fletcher writes that Bean has bred this species on Vaccinium and on Salix. (S. H. S.)

cago sativa, (M. denticulata), Astragalus caryocarpus, Pisum sativum, Vicia cracca, Cytisus, Caragana.

EURYMUS EURYTHEME. *Leguminosae*, Trifolium reflexum,* T. stoloniferum,* T. repens, T. tridentatum, Hosackia, (Astragalus caryocarpus, A. crotalariae).

ANTHOCHARIS GENUTIA. *Cruciferae*, Sisymbrium thaliana, Barbarea vulgaris, Arabis perfoliata, Cardamine, (Capsella bursa pastoris).

PONTIA PROTODICE. *Cruciferae*, Brassica oleracea,* Lepidium virginicum, Thlaspi, (Capsella bursa pastoris), Alyssum maritimum; *Resedaceae*, Reseda; *Compositae*, Erigeron; (*Solanaceae*, Solanum carolinense).

PIERIS OLERACEA. (*Ranunculaceae*, Caltha leptosepala); *Cruciferae*, Brassica rapa,* B. oleracea, Raphanus sativa, Nasturtium armoracia, Sinapis,* Arabis* drummondii, A. perfoliata, Barbarea vulgaris.

PIERIS RAPAE. *Cruciferae*, Brassica oleracea,* B. napa, Nasturtium armoracia, Raphanus, Sinapis, Matthiola, Alyssum maritimum, Nasturtium palustre, Barbarea vulgaris, Cakile americana; *Resedaceae*. Reseda odorata; (Geraniaceae, Tropaeolum).

In Europe: *Cruciferae*, Brassica, Sinapis. Nasturtium, Hesperis, Matthiola, Chieranthus, Erysimum, Lepidium, Raphanus; *Resedaceae*, Reseda; *Salicaceae*, Salix.

LAERTIAS PHILENOR. *Aristolochiaceae*, *Aristolochia** serpentaria, A. sipho, Asarum canadense; *Polygonaceae*, Polygonum (convolvulus).

IPHICLIDES AJAX. *Anonaceae*, Asimina triloba,* A. parviflora, A. grandiflora, A. pygmaea, Anona palustris; *Lauraceae*, Benzoin odoriferum; *Ericaceae*, Vaccinieae.

JASONIADES GLAUCUS. *Magnoliaceae*, Liriodendron tulipifera,* Magnolia acuminata; *Tiliaceae*, Tilia americana; *Rutaceae*, Ptelea trifoliata; (*Vitaceae*, Vitis); *Rosaceae*, Prunus, P. serotina, P. pennsylvanica, P. virginiana, P. americana, Pirus malus, Cydonia vulgaris, (Crataegus); *Styracaceae*, Styrax americana; *Bignoniaceae*, Catalpa bignonioides); *Oleaceae*, Fraxinus sambucifolia,* F. platycarpa, F. americana, F. trifoliata, Syringa vulgaris; *Lauraceae*, Sassafras officinale: *Urticaceae*, Humulus lupulus; *Juglandaceae*, Carya; *Cupuliferae*, Quercus tinctoria; *Betulaceae*, Betula* alba, B. lenta, Alnus incana; *Salicaceae*, Salix; Populus* tremuloides.

EUPHOEADES TROILUS. *Magnoliaceae*, Magnolia glaucus; *Rutaceae*, Xanthoxylum americanum; *Rosaceae*, Prunus serotina, P. persica, Pirus arbutifolia; (*Convolvulaceae*, Ipomaea batatas); *Oleaceae*, Syringa vulgaris; *Lauraceae*,* Benzoin odoriferum, Sassafras officinale; *Coniferae*, Juniperus sabiniana.

HERACLIDES CRESPHONTES. *Rutaceae*,* Citrus,* Ptelea trifoliata, Xanthoxylum americanum, X. clava-herculis, Dictamnus fraxinella; *Cornaceae*, Nyssa multiflora; *Lauraceae*, Persea carolinensis; *Salicaceae*, Populus dilatata; *Piperaceae*, Piper peltatum, P. umbellatum, P. mollicornum.

PAPILIO POLYXENES. *Rutaceae*, Dictamnus fraxinella: *Umbelliferae*, Daucus carota,* Hydrocotyle, H. umbellata, Conium maculatum, Cicuta maculata, C. virosa, C. bulbifera, Sium cicutaefolium, Apium* divaricatum, A. graveolens, Discopleura capillacea, Carum petroselinum, C. carui, Anethum graveolens, Foeniculum vulgare, Archangelica, Tiedemannia, T. teretifolia, Pastinaca sativa, (Arracia esculenta).

EUDAMUS PROTEUS. *Cruciferae*, Brassica; *Leguminosae*,* Wistaria frutescens, Desmodium viridiflorum, Phaseolus perennis, Clitoria mariana, C. ternatea.

EPARGYREUS TITYRUS *Leguminosae*, Amorpha fruticosa, Robinia pseudacacia, R. viscosa, R. hispida, R. neomexicana, Wistaria frutescens, Lespedeza capitata, Lathyrus paluster, Apios tuberosa, Desmodium marylandicum, D. nudiflorum, D. canadense, Amphicarpaea monoica, Gleditschia.

ACHALARUS LYCIDAS. (*Fumariaceae*, Corydalis glauca); *Leguminosae*, Desmo-

dium* dillenii, D. paniculatum, (Indigofera, Baptisia?); *Convolvulaceae*, Ipomaea pandurata.

THORYBES BATHYLLUS. *Leguminosae*, Rhynchosia tomentosa, Tephrosia ambigua, Centrosema virginianum, (Lespedeza hirta).

THORYBES PYLADES. *Leguminosae*, Trifolium* pratense, T. repens, Lespedeza capitata,* L. hirta, Desmodium dillenii.

THANAOS LUCILIUS. *Ranunculaceae*, Aquilegia canadensis;* (*Chenopodiaceae*, Chenopodium album).

THANAOS PERSIUS. *Salicaceae*, Salix humilis, Populus balsamifera, P. tremuloides, P. grandidentata.

THANAOS JUVENALIS. *Leguminosae*, Apios tuberosa, Lathyrus, Galactia pilosa, (G. glabella); *Cupuliferae*, Quercus* phellos, Q. ilicifolia, Q. alba, Corylus.

THANAOS HORATIUS. *Leguminosae*, Wistaria frutescens.

THANAOS TERENTIUS. (*Leguminosae*; *Cupuliferae*.)

THANAOS MARTIALIS. (*Rhamnaceae*, Ceanothus americanus); *Leguminosae*, Indigofera caroliniana; (*Haemodoraceae*, Lachnanthes tinctoria).

THANAOS AUSONIUS. (*Leguminosae?*).

THANAOS BRIZO. *Leguminosae*, Galactia glabella; *Cupuliferae*, Quercus ilicifolia.

THANAOS ICELUS. (*Leguminosae*, Baptisia?); *Hamamelaceae*, Hamamaelis; (*Cupuliferae*, Corylus); *Salicaceae*, Populus tremuloides, (Salix cordata).

PHOLISORA CATULLUS. (*Compositae*, Ambrosia); *Labiatae*, Monarda punctata, Origanum vulgare; *Chenopodiaceae*, Chenopodium album;* *Amarantaceae*,* Amarantus albus.

HESPERIA MONTIVAGA. *Malvaceae*, Sida, Althaea, Malva, Abutilon avicennae.

HESPERIA CENTAUREAE. (*Labiatae*, Mentha?)

ANCYLOXIPHA NUMITOR. *Gramineae*.

PAMPHILA MANDAN. *Gramineae*, Panicum crus galli, P. sanguinale, Triticum repens.

AMBLYSCIRTES VIALIS. *Gramineae*, Poa pratensis.

AMBLYSCIRTES SAMOSET. *Gramineae*.

POANES MASSASOIT. (*Gramineae*.)

PHYCANASSA VIATOR. (*Gramineae*.)

ATRYTONE LOGAN. *Gramineae*, Erianthus alopecuroides.

ATRYTONE ZABULON. *Gramineae*.

HYLEPHILA PHYLAEUS. *Gramineae*, Panicum sanguinale.

ERYNNIS SASSACUS. *Gramineae*, Panicum sanguinale.

ERYNNIS MANITOBA. (*Gramineae*.)

ERYNNIS METEA. *Gramineae*.

ERYNNIS ATTALUS. (*Gramineae*.)

ATALOPEDES HURON. *Gramineae*, Cynodon dactylon.

ANTHOMASTER LEONARDUS. *Gramineae*.

POLITES PECKIUS. (*Gramineae*.)

THYMELICUS AETNA. (*Gentianaceae*, Sabbatia gracilis, S. elliottii); *Gramineae*, Panicum sanguinale.

THYMELICUS BRETTUS. *Gramineae*, Paspalum ciliatifolium.

THYMELICUS MYSTIC. *Gramineae*.

LIMOCHORES BIMACULA. (*Gramineae*.)

LIMOCHORES MANATAAQUA. *Gramineae*.

LIMOCHORES TAUMAS. *Gramineae*.

LIMOCHORES PONTIAC. (*Gramineae*.)

EUPHYES METACOMET. (*Gramineae*.)

EUPHYES VERNA. (*Gramineae*.)

CALPODES ETHLIUS. *Cannaceae*, Canna flaccida, C. indica.

OLIGORIA MACULATA. (*Gramineae*.)

LEREMA ACCIUS. (*Leguminosae*, Wistaria frutescens); *Gramineae*, Zea mays, Erianthus alopecuroides.

LEREMA HIANA. (*Gramineae*.)

Parasitism of Hippodamia convergens. —On page 188 of the present volume of *Psyche* is an article by C. M. Weed and C. A. Hart in which is recorded their observations on the lady-beetle parasite (*Perilitus americanus*), an account of which was first given by Dr. C. V. Riley on page 101 of volume 1 of *Insect life*. All of the observations referred to in these articles speak of this parasite as attacking *Megilla maculata* except in one instance where Dr. Riley speaks of one specimen of *C. 9-notata* which was probably attacked by the same parasite. I wish to add *H. convergens* to the list, a single specimen of which I took on the 17th of August, 1889, from a corn leaf where it was standing dead, over a little brown cocoon exactly as *M. maculata* is represented in *Insect life*. The parasite had escaped when the discovery was made.

This has been the most common lady-beetle at Ames, Iowa, the past summer wherever plant lice have been abundant.

*C. P. Gillette.*

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Emphytus cinctus in America. — Late in the autumn of 1887 I found a large number of sawfly larvae, not before observed, on the under side of leaves of several species of rose bushes at the Arnold Arboretum and one or two other places in the vicinity of Boston. Early in 1888 two or three sawflies emerged from some larvae which had been kept in confinement from the previous autumn, but being forgotten little more than the wings were found. The larvae were again plentiful in 1888 and about 15 Sept. I succeeded in raising several perfect sawflies. These I was unable to determine or to get determined for me. The past summer I raised one or two more from larvae and captured a number of the sawflies as they were flying about rose bushes. Unable to find any American species to correspond with these, I referred to descriptions of European species and have been able to identify my specimens beyond doubt as *Emphytus cinctus* L. a species common in England and on the Continent. These American specimens also agree in all particulars with European specimens in the Museum of comparative zoology at Cambridge.

*J. G. Jack.*

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Power of Vision in Vespidae. — One day in the middle of July, while confined by illness to my tent on the summit of the Roan Mountains, Col., I was able to watch at leisure the operations of a couple of wasps which had entered the tent and were searching for flies along the tent roof. The tent was an ordinary wall tent, 10 ft. × 12 ft., where, lying upon his back, the observer might readily follow all the movements of these creatures. There were also in the tent perhaps a dozen or twenty flies, mostly collected near the ridge pole, especially, when not in flight, alighting upon a rope which stretched from one of the upright poles supporting the tent to the other, just below the ridge pole. The wasps were in incessant motion, and in the course of one morning were seen to capture only three or four flies, the flies usually being able to dodge them whenever an attack upon them was made. I was unable to see that a wasp accelerated its motion in the least when approaching the flies or directed its flight immediately upon them until within two or three inches of its intended victim; and as it often passed one by at no greater distance than this without any attempt at capture, the impression was strong that the wasp's distinct vision while in flight did not exceed this distance. But what was most surprising was the great number of mistakes made by the wasps. Every slight stain or defect in the canvas or minute shadow upon it was repeatedly attacked by the wasps as if they supposed it to be a suitable object for food. There seemed to be no power on their part of distinguishing between a spot of color upon the canvas having no elevation whatever and an object or body resting upon it. Several times the shadow made by a fly

alighted upon the outside of the tent was pounced upon by the wasps on the inside, and such objects, mere shadows or stains, were repeatedly attacked by the same wasp over and over again, often with only half a minute's interval or even less than that. I can not now recollect exactly the estimate I made at the time (but failed to record) of the relative number of attacks upon false objects to those upon proper victims, but I am under the impression that the mistakes were to the correct judgments as twenty or thirty to one. My observations were continued for two or three hours and repeated on subsequent days for briefer times, always with an identical result. These observations seem to be entirely in keeping with the forced experiments of Professor Plateau upon the vision of wasps, and lead to the conclusion formulated by him that the vision of these insects, even when in flight, is exceedingly defective, judged by our own standards.

*Samuel H. Scudder.*

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SECOND BROOD OF CALLOSAMIA PROMETHEA.—Last May and June a large number of *Callosamia promethea* emerged in my house and mated. From these I obtained a brood of larvae some weeks in advance of those to be found out of doors. These pupated in June and July, and, to my surprise, I raised a second small brood of more than a dozen specimens before the 20th of August. Some of these hatched at a normal summer temperature, others in the sun, or near a fire. The greater part of them were males. The two sexes paired readily. On the 20th and 21st respectively I found a large male hovering about the cage in which my females were kept. It would be interesting to know whether these free males belonged to another brood or had hatched from cocoons made by escaped members of the same brood to which my females belonged, as this would go far toward settling the question of an occasional second brood under natural conditions in this species.

The eggs laid by my females began to hatch 4 September and at first ate well and seemed to be thriving; but by the 28th most of them had succumbed, either to some innate weakness, or to the unusual dampness which caused such mortality amongst larvae during the summer of 1889.

*Holmes Hinkley.*

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NOTES ON EMESA LONGIPES, De Geer.—This interesting insect has been very abundant in Central Ohio during the past summer, occurring especially in a row of Norway spruces on the university grounds, where we have collected great numbers by beating. I kept a number alive in the insectary, and obtained many of the eggs, which I believe have never been described.

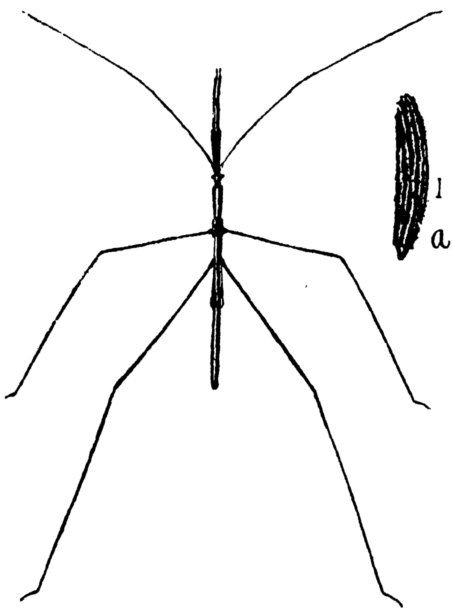
Besides the trees above mentioned these bugs were frequently obtained in miscellaneous beatings in the woods, and occasionally occurred in numbers in carriage sheds.

The only observation upon their feeding habits I am able to record was made by an assistant, Mr. F. W. Rane, who found one in a shed devouring a small white moth, possibly *Spilosoma virginica*, grasping its victim by its strong front legs.

This *Emesa*, with its exceedingly long legs and body, and small wings, seems poorly prepared for flying, and as a matter of fact it is very difficult to get one to fly by disturbing it. That they do so voluntarily, however, was shown by their being taken on the wing in the middle of a field. In the Proceedings of the Boston society of natural history v. 14, p. 391, Dr. Hagen states that the eggs are of an elongated, conical form.

The only other mention of the eggs I have found is the following sentence by Mr. Uhler in the Standard natural history (v. 2, p. 277): "We do not yet know where it deposits the eggs; but from analogy we are led to believe that these are glued to the twigs of bushes and trees, just as is the case with many others of the great group to which this species belongs."

I obtained the eggs a number of times during the month of September. They were from confined females, deposited on the sides of the breeding cage, apparently being glued to the wood. They are black, 2.5 to 3 mm. long, subcylindrical in shape, with numerous longitudinal ridges having jagged edges. At the lower end is a distinct flange, inside of which is a circular depression, from which arises a conical projection as shown at *a* in the accompanying illustration.




These eggs are probably glued to the bark of trees, especially evergreens, as surmised by Mr. Uhler, and apparently this is the state in which the species passes the winter.

I am indebted to my assistant, Miss Freda Detmers, for the drawings from which the accompanying figures have been reproduced.

*Clarence Moores Weed.*

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**Description of the larva of Osmoderma scabra, Beauv.**—Color. Head testaceous, mandibles piceous; body sordid white, becoming semi-translucent toward the posterior portion, showing the color of the contents of the body; covered sparsely but regularly with reddish-brown hairs; on each side of the first segment is a corneous testaceous patch; spiracles and extremities of the thoracic feet also testaceous.

Head sub-ovate, slightly rugose, shiny posterior portion and sides well rounded; anterior portion angulated and somewhat truncate.

Clypeus transversly oblong, sides oblique, broader than long.

Labrum rugose, rounded at the sides and front, a little broader than the clypeus, but not as long.

Antennae four jointed; first joint cylindrical, swollen at the apex; second and third joints about half as long as the first, also swollen at the apex; fourth joint conical, and about as long as the first.

Mandibles stout, quadridentate, at the apex, excavate internally, base prominent with three broad blunt teeth.

Maxillae prominent, rather stout, not extending beyond the mandibles; lobe subcylindrical, with a sharp bristle at the apex.

Maxillary palpi extending beyond the lobe, three jointed; first and second joints subglobose, terminal joint longer, conical.

Labium subquadrate, somewhat broader than long.

Labial palpi, two jointed, first joint cylindrical, second joint longer, conical.

Body curved, stout; rounded above and flattened beneath, with numerous transverse wrinkles, except on the last segment which is smooth.

Length about 35 mm. Width about 15 mm. Lives socially in decaying wood of sweet gum (*Liquidambar*), hickory (*Carya*), poplar (*Populus*), willow (*Salix*), sycamore (*Plantanus*), sassafras (*Sassafras*), maple (*Acer*), oak (*Quercus*), and chestnut (*Castanea*).

*William Beutenmüller.*

## PROCEEDINGS OF SOCIETIES.

### CAMBRIDGE ENTOMOLOGICAL CLUB.

(*Continued from p. 153.*)

8 APRIL 1887. — The 128th meeting was held at 156 Brattle St., Cambridge, on Friday, 8 April, 1887. The president, Mr. J. H: Emerton in the chair.

In the absence of a quorum no business was transacted.

Mr. C. W. Woodworth showed photographs representing the venation of the wings of various coleoptera. The venation of the wings of the *adephaga* differs from that which pertains in the other coleoptera, with the exception of the *cupesidae*. Mr. Woodworth has devoted considerable time to this subject and says that he has had no difficulty in recognizing some of the families of the order by means of the venation of their wings. The result which will probably be obtained from his study promise to be of considerable value.

Mr. S. H. Scudder spoke of the importance of such a method of separation in the determination of the fossil forms of coleoptera, as in many cases the wings are the only parts well preserved.

Mr. Woodworth then stated that he has found another difference between the *adephaga* and the lower coleoptera. The ovarioles of the former series belong to the same type as those of the hymenoptera, diptera, lepidoptera and neuroptera, while a different type is found in the rest of the order and in all other insects, with the exception of the viviparous *aphidae*, the ovarioles of which, although said to resemble those of the hymenoptera, etc., appear rather to be intermediate between the two types above indicated.

Mr. Scudder showed his collection of American and European caterpillars.

Mr. Woodworth stated that he believed the color of the larvae of *Papilio cresphontes* to be protective.

Mr. Scudder recorded the capture of *Phyciodes batesii* in the White Mts., in June, 1886, and remarked on the probable identity of this species and *P. tharos*.

Mr. R. Hayward showed specimens of *Aphodius pumilus*, from New Mexico, a species described by Dr. Horn in a monograph of the genus now in press. Mr. Hayward's specimens are from the valley of the Rio Animas. He also showed specimens of our two species of *Amphizoa* (*A. insolens* Lec. and *A. lecontei* Matth.) and remarked on the differences between them.

13 MAY 1887.—The 129th meeting was held at 61 Sacramento St., Cambridge, 13 May 1887; The president, Mr. J: H. Emerton in the chair.

Mr. S: H. Scudder showed an egg of *Thecla strigosa* collected at Turkey Hill, Arlington, and also a drawing of it by Mr. Emerton. The egg was protected in a curious way by threads which fastened it to the twig on which it was laid.

Mr. R. Hayward exhibited specimens of various North American species of *Nebria*, and remarked briefly on the habit of *N. purpurata* and *N. trifaria* as observed by him in Colorado.

Mr. C: W: Woodworth exhibited a collection of *phalangidae* from Illinois.

10 JUNE 1887.—The 130th meeting was held at 61 Sacramento St., Cambridge, and was called to order by the president. Mr. J. H: Emerton.

Mr. J. H: Emerton showed some parasites of spiders in their various stages, which he had taken near Roberts Station, Waltham. From one of these parasites the hymenopterous imago had been obtained. (See *Insect life*, v. 1, p. 106-107.)

14 OCTOBER 1887.—The 131st meeting was held at 61 Sacramento Street, Cambridge; the president, Mr. J. H: Emerton in the chair. The publication of PSYCHE was discussed at some length.

11 NOVEMBER 1887. The 132nd meeting was held at 61 Sacramento St., Cambridge. In the absence of the president, Mr. George Dimmock was chosen chairman.

Nomination 144, that of Mr. W. S. Wads-

worth, of Cambridge, for active membership, was presented by Messrs. C. W. Woodworth and G: Dimmock.

The chair appointed Messrs. S: H. Scudder, J. H: Emerton, R. Hayward, C: W: Woodworth and G: Dimmock a committee to consider the feasibility of publishing PSYCHE.

Mr. C: W: Woodworth remarked on two larvae he had observed.

Mr. R. Hayward showed a specimen of *Erebus odora* from Lower California.

Mr. Dimmock spoke of a cocoon of a lepidopterous larva he had observed, which was made entirely of human hair.

9 DECEMBER 1887.—The 133rd meeting was held at 61 Sacramento St., Cambridge. The president, Mr. J. H: Emerton, in the chair.

The report of the committee appointed at the last meeting to consider the feasibility of continuing the publication of PSYCHE was presented by Mr. S: H. Scudder, chairman of the committee. The report was accepted and in accordance with the recommendations of the committee it was voted to begin a new volume with 1888.

Mr. S: H. Scudder read a letter from Miss Adele M. Fielde, and exhibited, among other specimens sent him by that lady from China, two specimens of a grasshopper (*Conocephalus acuminatus*), the chirp of which, as Miss Fielde aptly expresses it, "makes the heat audible."

Mr. Scudder showed some larvae and pupae of *Pieris rapae* which he has kept in a half and half mixture of glycerine and water since 1871. They still retained their color.

Mr. Holmes Hinkley showed some specimens of spiders which he had taken from the cells of a mud-wasp.

Mr. J. H: Emerton showed a specimen of *Lycosa kochii* which makes a noise by drumming on the leaves. The species lives amongst dead leaves in the woods and the drumming is supposed to be done with the palpi. The specimen in question was from Staten Island and was collected by Mr. W. T. Davis who would publish his observations in the Proc. Nat. hist. assoc. of Staten Island Mr. Emerton said that he did not know of the occurrence of this spider in this vicinity.

Mr. J. W. Folsom stated that he had observed this spider near Arlington.

Mr. G: Dimmock showed a Swiss spider which had bitten him, causing considerable poisoning.

Mr. Emerton identified it as a species of *Tegenaria*. Mr. Emerton then examined the spiders shown by Mr. Hinkley and found amongst them several species, the majority being young *Epeira*. He remarked that spiders stored in the nests of mud-wasps remain pliable for some time.

Mr. C: W: Woodworth remarked that he had known instances where one of the spiders had recovered and devoured the rest.

Mr. Hinkley stated that he had examined the larvae of some *smerinthi* and observed the ichneumon larva feeding under the skin, and in a few hours the pupa was found on the outside. He then asked how this was brought about.

In answer to the inquiry, Mr. S: H. Scudder stated that the larva emerges and forms its cocoon on the outside in a very short time.

Mr. Woodworth asked what effect the warm weather would have upon insect life.

Mr. S: Henshaw showed a piece of bed ticking with a felting produced by *Attagenus megatoma*. The larva gnaws the feathers, forming a fine dust, and the felting is stated by Prof. C: V. Riley to be due to the mere mechanical process of beating and shaking.

COLORADO BIOLOGICAL ASSOCIATION.

(*Continued from p. 228.*)

REPORT ON ENTOMOLOGY—APRIL 1889. — The membership now numbers 61; two entomologists have become members during the month, Miss Emily L. Morton and Prof. James Cassidy. Four coleoptera, 749 hymenoptera, and a fossil thysanuran have been added to our Colorado list. The very numerous additions in hymenoptera are derived from a full list of the Colorado

species drawn up with great care and labor by Mr. W: H. Ashmead, and now waiting publication.

A short 13th Report has been published, containing a figure of the "wound-gnat." Dr. John Hamilton has examined a small collection of Custer co. coleoptera, and finds therein a probably undescribed species of *gyrinus*. Mr. W: H. Ashmead has reported on some Custer co. hymenoptera, five of which are new species, one *Vibrio coloradensis* Ashm. being the first of its genus detected in the United States. In Wet Mountain valley, *Pyrameis cardui* has been out in great force; and contrary to all expectations, *Colias eurytheme* var. *intermedia* appeared on 28 April. Last year no orange forms appeared in the early spring, all were *autumnalis*. *Photopsis alcanor* Blake has appeared at light: this is a spring species in Wet Mountain Valley, being wholly supplanted by *P. glabrella* Cr. later in the year. An empty *Smerinthus* egg found on a willow leaf at West Cliff has aroused some curiosity, as *S. astarte*, the only known species in the district, was believed to feed on *Populus*. A larva of *Hipparchia ridingsii* was found hibernating under a rock in Custer co., and sent to Mr. W: H. Edwards, who reports it to be in good health, and it will no doubt form material for one of Mr. Edwards's admirable life-histories.

Report on Entomology—May, 1889.—The recent election of officers and council has resulted as follows: *president:* C. F. Morrison, *sec'y:* T. D. A. Cockerell, *treas.:* H. G. Smith, Jr., *council:* C. H. Merriam, H. W. Nash, A. S. Packard, D. Gale, D. W. Park, and J. M. Coulter. The membership is now 65; two entomologists, Messrs. L. O. Howard and J. W. Tutt have joined during the month. The additions to the Colorado insect-fauna for May are rhopalocera, 1 var.; heterocera, 6 and 1 var.; homoptera, 1; and diptera, 3.

A good deal of work has been done which cannot now be reported on fully. Galls collected at West Cliff have produced an abundance of hymenoptera and diptera, which will form material for an extensive account in the future. Galls of *Rhodites bicolor* Harr. have been especially prolific in chalcid parasites, as also have those of *Cecidomyia salicis-strobiloïdes* O.—S. Small flat leaf-galls on rose have produced *Rhodites rosaefolii* n. sp., as well as some chalcids.

An interesting *Trypeta* has been bred from woolly galls on *Bigelovia*. The sawfly reared from a larva, about 20 mm. long, light bluish green marked with yellow patches and black spots, found on willow in West Mountain Valley last year, has been indentified as a new species of *Messa* by Mr. Ashmead, and both imago and larva will be described fully hereafter as *M. salicum* n. sp. Among diptera, *gonia exul* Willist. was found at West Cliff 16 May, and 25 May, the curious pupae of a species of *Microdon* were found in a nest of *Formica integra* at the same place. A probably new species of *Orthezia* has turned up in an ant's nest in Custer co.—but of this more hereafter. Mr. H. G. Smith Jr., has sent specimens of *Phyllotreta pusilla* Horn (= *albionica* auct., non Lec.) from Denver, where they are injurious to the cultivated cruciferae. *Pyractomena borealis* appeared at West Cliff on May 26. It was found that the light of this beetle could be intensified at will by gently pressing the thorax and fore part of the abdomen between the finger and thumb. *Pamphila uncas* (kindly indentified by Mr. W. H. Edwards), was found abundantly on a dry beach above Grape Creek in Custer co., visiting the flowers of *Senecio* and *Erysinum*. Mr. H: Edwards has identified a new species of *Aegeria* from Custer co., which he will describe later.

*T. D. A. Cockerell (Secretary).*

No. 156 was issued 15 April 1889.
No. 157-159 were issued 28 July 1889.

PSYCHE

A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

Vol. 5. No. 165.

JANUARY 1890.

CONTENTS:



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20C.

[Entered as second class mail matter.]

PSYCHE.

# THE WORK OF A DECADE UPON FOSSIL INSECTS, 1880–1889.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

[Annual address of the retiring president of the Cambridge Entomological Club, 10 Jan. 1890.]

Some years ago I published an annotated and tolerably complete list of papers on fossil insects. It contained nearly three times as many titles as were referred to by Hagen in his entomological bibliography nearly twenty years previously, but, as the multiplication of periodical literature had brought in a train of minor papers, largely abstracts and compilations, I remarked that the far greater extent of my list was no proof of an increased recent interest in this field of research, but thought it doubtful whether in the intervening period there had been as much activity as when the works of Heer were opening the wealth of material at hand.

So marked a change has now come about in this respect that I venture this evening to invite your attention to a review of the advance that has been made during the past ten years in this previously neglected field. In doing this I do not by any means propose to cite every paper that has been published, but only to call your attention to the more important or interesting, from whatever cause, and thus endeavor to picture our progress as vividly as possible. Indeed, the mere list of authors would be wearisome, for one could make a catalogue of the writings of the last ten years considerably longer than the entire list given by Hagen in 1863. To be precise, I can cite 94 authors and about 225 papers published in this decade, against 78 authors and about 140 papers quoted by Hagen. Or to picture it in another way, about one third of a complete catalogue of papers on fossil insects would belong to the decade just closed. Nor is the bulk of this literature its only value; it is quite as remarkable for its quality, for by far the most important of the discoveries yet made in fossil insects are embodied in the researches of the last ten years, and there is no reason to suppose that we have reached their conclusion.

Note, first, the relatively great number of striking discoveries that have been made within this period. The discovery and careful study of Silurian scorpions in several different parts of

the world,—in Sweden by Thorell and Lindström, in Scotland by Peach and Hunter, and in New York by Whitfield, all brought out at very nearly the same time, are unprecedented in the annals of this division of science. These were followed almost immediately by Brongniart's surprising discovery of one of the hexapods, *Palaeoblattina*, in the Silurian of France, still the only known true insect in this ancient deposit. Coming down a stage later we have the remarkable Devonian insect-fauna of New Brunswick, about the nature of which there has been so much dispute, first announced, it is true, before our period, but only fully published with figures of the species in 1880; a single addition or two has recently been made to them by Matthew. With them must be classed the Devonian myriopods, the earliest known members of that group, fully elaborated by Peach. In the carboniferous period we have the striking wealth of forms from Mazon Creek and other deposits in our country which I have described at various times, including so extraordinary a number of blattarians that I have ventured to call this period, so far as its insect-fauna is concerned, "the age of cockroaches." These discoveries, largely due in this country to the activity and zeal of Mr. Lacoe, have been even more than paralleled by the unexampled wealth rightly claimed for Commentry in France by Brongniart, who as yet has published hardly more than an outline sketch to whet the appetite of the zealot. At this place are found, as Mr. Brongniart informs me in a recent letter, a considerable number of types already signalized in America, which indeed we had a right to anticipate by the comparisons that had been made between the forms already published from other localities in the two countries, new discoveries on one continent having repeatedly been followed sooner or later by very similar finds on the other. The abundance of cockroaches in both countries is fully sustained at Commentry, which has yielded the vast number of nearly six hundred specimens, or many more than are known from all other carboniferous localities in the world taken together. Still another striking discovery in the carboniferous rocks is the recent finding in Silesia of coleoptera, the first time that these have been signalized at this early epoch, but their description is yet to come.

These are the principal larger discoveries in the paleozoic series, but they have been accompanied by the publication of many striking forms which indicate the ancestral types of living insects, or by the better elucidation of types already known but whose significance had not been understood. To specify some of these we may mention *Palaeocampa* and *Acantherpestes* among the myriapods, the former with the curious and highly developed structure of the spinous hairs, the latter with its possession of segmental organs or branchial supports as well as stigmata, indicating a probable amphibious habit; *Anthracomartus*, *Kreischeria*, and *Geralinura*, the two former examples

of new extinct family types of arachnids, the last the first instance of the discovery of the *pedipalpi* earlier than the tertiaries, and found at brief intervals on two continents; other than this last of Kušta's striking discoveries in the Bohemian coal field might well be cited; the gigantic ephemerid, *Palingenia*, of Bohemia; *Dasyleptus*, an extraordinary form of thysanura, a group not previously known earlier than the tertiaries; *Corydaloides*, like the preceding, one of Brongniart's discoveries at Commentry, remarkable for the extensive display of branchiae on the sides of the abdomen; *Petrablattina subtilis* of Kliver (Strephocladus) with its strange neuration; *Brodia* of England with its remarkable coloration; the gigantic *Titanophasma*, also from Commentry; the nymph of *Etoblattina* Woodward has published from England, showing the same mode of development among the ancient as the modern cockroaches; and, finally, *Phthanocoris*, the only hemipteroid type yet found in our own paleozoic rocks.

All these memoranda relate to the insects of the older formations only, but the statements regarding them in no proper way indicate the immense strides we have made in our knowledge of the earlier types. The decade has been marked not only by extensive and striking additions to known types, far more than doubling the number that had been previously published; it has witnessed also the advent of many original workers previously wholly unknown in this field, such as Beecher, Deichmüller, Karsch, Kliver, Kušta, Matthew, Peach, Sterzel, Thorell, and Whitfield; but it has also seen the beginning of a new epoch in the study of the earlier types, in that for the first time the subjects have been treated in much more than a scattered way, by fuller discussions of the systematic status of the insects described, by attempts to systematize our knowledge, and by the treatment in single groups of insects from various or from all deposits, and not alone in the simple discussion of collections from a given deposit. Let us hope that the constantly increasing material and our larger knowledge may permit in a new decade a further correlation, by the comparative study of insects of different horizons, especially in the carboniferous age.

Previous to the last decade there had been scarcely a single attempt at the systematic study of all the older insects, or even of any of the minor groups found in the paleozoic rocks. Hagen, indeed, had treated briefly of the few *termitina* known over thirty years ago; Heer had attempted a grouping of the cockroaches; and Goldenberg had summarized our knowledge of all by an attempted classification; but besides these I do not recall a single instance where any serious attempt had been made to collate in a broad way our knowledge of paleozoic insects as a whole or in any of the parts. Only because it has so happened that the present speaker has been perhaps the most active worker in this narrow field during the last decade, is he obliged here to mention mainly his own work, since

it has fallen to his lot, in however imperfect a way, to attempt a more or less monographic treatment of the extinct type of *archipolypoda*, for instance, comprising most of the paleozoic myriopoda; of the paleozoic arachnida as a whole, in which he had been preceded by this decade by Karsch, working on much slenderer material and therefore at much smaller advantage; also on the paleozoic cockroaches, and on the species of *Mylacris*, a genus of cockroaches known from several American deposits; and on the genera allied to *Dictyoneura*, regarded as ancient types of *phasmida*. Reference should here also be made to Peach's careful work on the carboniferous arachnida of Scotland. In my memoir on the cockroaches, embracing the discussion of fifty-eight species referred to eleven genera, it was claimed that their differences from modern types were so fundamental as to warrant their separation from all subsequent and from living cockroaches as a distinct and equivalent group, called *palaeoblattariae*, and that they could be further separated into two divisions, called respectively *mylacridae* and *blattinariae*, of which the former was confined to the New World. Brauer has since questioned the value of the *palaeoblattariae* as a group, and Brongniart has recently stated that in the enormous crowd of cockroaches found at Commentry, the *mylacridae* are as numerous as the *blattinariae*, which probably means that the fauna of Commentry is older than that of the other carboniferous deposits of Europe and synchronous or nearly so with most of the cockroach-yielding deposits of America.

Both Brongniart and myself have also attempted new classifications of the paleozoic hexapods as a whole, which differ considerably in character, but which cannot yet fairly be compared; first because mine discusses nearly all the known types, but includes hardly any of those found at Commentry, then almost wholly unknown, while Brongniart, writing later, confines himself almost entirely to those of Commentry, with only an occasional allusion to previously described types; but principally because Brongniart's work is, so far, the merest sketch with hardly any structural details, a forerunner of what he will soon publish *in extenso* concerning this wonderful fauna, while mine contains full structural details as a basis for discussion and generalization. In it I have endeavored to point out that the existing orders of insects were not differentiated in paleozoic times except in a feeble way, prophetic as it were of the future, so that the Palaeodictyoptera, as, after Dohrn and Goldenberg, but with an extension of their usage, I had classed for the first time all known paleozoic insects, could only be separated into neuropteroid, orthopteroid and hemipteroid groups. These views, which I urged also in a special paper showing the development of the insect-type in time, have been so strenuously opposed by Brauer and others, that their further discussion can hardly be profitable except for those who have an unfortunate

taste for polemics, at least until the fauna of Commentry, which will certainly double the field of observation, gives us a fairer basis for judgment. Meanwhile it may be said that Brongniart in his sketch hints by many of his terms that he has found the same difficulties as those which faced me, and has been forced to admit a synthesis of structure in at least some of the older types, which indeed the very laws of evolution would render probable.

At the beginning of this decade our knowledge of mesozoic insects was very limited; it was almost entirely confined to the researches of Germar, Giebel, Hagen and Weyenbergh on the Jura of Eichstätt and Solenhofen; to Heer's account of the Liassic insects of Aargau; and to Brodie's and Westwood's publications on the secondary insects of England. The horizon has been somewhat extended of late years by the thorough discussion of the Bavarian insects by Deichmüller and by Oppenheim; by the careful exploitation of a new locality for Liassic insects at Dobbertin, Germany, by F. E. Geinitz; by the considerable number of new generic and specific types of cockroaches from the secondary rocks of England described by myself; by the repeated, though not extensive, discoveries of Fritsch in Bohemia, adding interesting material for our very meagre knowledge of cretaceous insects; and by the discovery at Fairplay, Col., of a collection of triassic cockroaches of special interest and importance.

Among noteworthy contributions to our knowledge of the insects of this epoch may be mentioned Oppenheim's study of the group he called *rhipidorhabdi*, which he regarded as a distinct order and an ancestral type of lepidoptera. The discussion of the structure of these insects, especially by Oppenheim and Deichmüller, has made clear many points regarding the Solenhofen insects which have always been obscure, and brought about the agreement that the *rhipidorhabdi* must be regarded as hymenoptera and in no sense predecessors of lepidoptera. Geinitz in his study of the Liassic fauna of Dobbertin has been able to extend considerably our knowledge of the structure of that prevailing mesozoic type, *Orthophlebia*, known entirely by its wings, and which he regards as phryganideous. In our own country, the triassic cockroach-fauna of Fairplay, just referred to, shows an interesting transition from the older to the newer forms, which goes far to substantiate the differences I have pointed out between paleozoic and later cockroaches; while the study of a large number of specimens of *Mormolucoides*, long but imperfectly known from the red sandstone of Connecticut, has enabled me to render it in a high degree probable that this oldest known insect-larva was a sialid.

In the monographic treatment of mesozoic insects we have only to record the discussion of the *rhipidorhabdi* already mentioned, and a systematic revision of the mesozoic cockroaches, based on a considerable collection of English forms new and old, lent me by

that veteran in their study the Rev. P. B. Brodie, a work which included more than seventy-five species, treated after the method employed in the revision of the paleozoic forms. The publication of both these memoirs on the ancient cockroaches, it may fairly be remarked, has since brought to light many more new forms, so that during the past decade there have actually been added to the number of pretertiary forms over a hundred species of cockroaches, about equally divided between paleozoic (53) and mesozoic (57) times. A general account of fossil cockroaches based on these data was given in my "Cockroach of the Past," in Miall and Denny's "Structure and life history of the cockroach" (London, 1886).

Passing now to tertiary times, we naturally cannot expect to meet with discoveries of equal importance and interest to those which throw light upon the origin of insect-forms, for it is a well known fact that the earliest tertiary insects are to all general intents and purposes identical with those of to-day. They differ no doubt specifically, and even to a considerable degree generically. Most of those so far recovered from temperate regions indicate a then warmer climate, but, taken as a whole, the grand features of insect-life appear to have been essentially the same since the beginning of tertiary times. By our present researches upon them we no doubt greatly widen our horizon, and as with modern types there always are found problems of interest, so will there be with fossil insects, however recent.

Activity in this field can hardly be said to be relatively so great as in the others, nor so great indeed as some time ago when Heer and Heyden were publishing extensively, but it nevertheless has not been insignificant, and it is noteworthy that more special work with groups has been undertaken; thus Buckton has summarized our knowledge of the fossil aphides, Schlechtendahl has elaborated the *psysopoda* of Rott, Gourret the arachnida of Aix, Hagen and Kolbe the *psocidae* of amber, and I the *termitina* of Florissant. I might also add the butterflies of Florissant, as my paper, though not yet published, has been months in type, and the general results were given in a brief paper on "Fossil butterflies" in general, in my "Butterflies of New England." Akin to these can only be mentioned the paper by Flach on the pleistocene coleoptera of Hösbach, Schlechtendahl's revision of Germar's tertiary fossils, Williston's notice of the Florissant *Syrphidae*, and mine of the Florissant arachnida, my comparison of the *Odonata* of Florissant and Green River, the detailed study of *Planocephalus* from Florissant, regarded by me as a new and practically headless type of thysanura, and, finally, the discussion of the structure of this strange type and of the supposed mite of the Rhenish brown coal, *Limnochares*, both of which Bertkau regards as *Galgulidae*. To this period also belongs my general survey of the paleontology of Florissant.

The additions to our knowledge of the amber insects of Prussia during the

past decade is surprisingly little. Besides the papers of Hagen and Kolbe on the *psocidae*, already alluded to, we have only a description of an *Embia* by Hagen, of three species of *Nothrus* by Karsch, of two *Bothrideres* by Stein, an account of *Elephantomyia* by Osten Sacken, and a generic list of hymenoptera by Brischke. Malfatti also describes two small insects from the Sicilian amber. A meagre showing indeed when the collections of unworked material are known to be so extensive. I have also noted but a single paper on the insects found in the recent gum copal, a description of two or three species by Quedenfeldt.

Here may fairly be mentioned a paper or two on recent insects which throw light on the structure of extinct types. One of these is the recent notice by de Selys Longchamps of the Japanese dragonfly, *Palaeophlebia*, which he makes the type of a new legion, to which he refers also *Heterophlebia* and other forms from the secondary rocks of England and Bavaria, and the tertiary deposits of the Rhine. In the other, on the post-embryonic development of *Julus*, Heathcote points out that the relations of the dorsal and ventral regions of the body of the young *Julus* correspond exactly with their permanent condition in *Euphoberia*, a carboniferous myriopod; and he further holds that the traces of the division of the dorsal plates found in the *archipolypoda* lend additional strength to the belief that they are composed in modern diplopods of two fused segments originally distinct; which the doubling of the internal organs and of the mesoblastic segmentation also indicates.

Among the new tertiary fields which have been opened, and which have given rise to some of these researches, and to others upon which I must not touch, are Felek in Hungary by Staub and others, Kutschlin, Bohemia, by Deichmüller, and various localities in upper Alsatia by Foerster, in the last of which about a hundred species have already been found, though none have yet been worked up. Peat beds have also begun to be sounded, and notes of their contents have been made by Früh, Geinitz, and Hollingworth, while similarly recent deposits have yielded a little to Brongniart, Kendall, and Sordelli. Wilkinson and Woodard have also shown us that insects may be expected from the tertiaries of Australia. To some places in our country I will refer later.

The more general diffusion of knowledge regarding fossil insects has been marked during the past decade. Important new discoveries have found their way into journals and into papers before scientific bodies, to such a degree that it is hard for the bibliographer to keep track of them. But besides these we have had very full analyses of the larger papers, among which those given by de Borre to the Belgian entomological society easily hold the first place. Bibliographies, like those of Malfatti and my own, annual reviews of the literature, like those given by Bertkau, Trouessart, Dalton, White, Marcou and others; general compilations of col-

lated material covering the whole field, like the excellent series published by Goss; others more or less partial or local, like the lists of Lacoe and Brongniart, or the dictionaries of Lesley and Miller, or some papers by Brodie and Goss; still others which pass the whole subject under one general review, like one of my own and those of Maurice and Vidal y Careta, — all these have served to advance in one way and another an interest in this department of science and to bring more or less order out of previous confusion or misunderstanding. The most pretentious of these undertakings is the general systematic survey entrusted to me by Zittel for his "handbook of paleontology," in which for the first time since Pictet and Giebel, or for more than thirty years, a systematic technical treatment of the entire series of fossil insects, myriopods, and arachnids was attempted, including tolerably full definitions throughout the paleozoic series and to some extent in the later, with a fullness and variety of illustration never before given. To gather together, as I believe is there done, even the smallest references and weld all into a connected whole would have been almost impossible, had I not begun at least twenty years ago a systematic card reference-catalogue in which every such allusion great or small is entered and which has been constantly perfecting and kept up to date. For English readers, the text of my contribution to Zittel's Handbuch was also published by our Geological survey, with a somewhat fuller treatment of the tertiary series, but without illustrations.

And now, in bringing this too long address to a close, you may perhaps ask what the outlook is for the future. I venture to predict that it will be quite as brilliant as the past. In the first place, publications bringing the whole known series of discoveries in systematic order up to date, like that just published, always have a tendency to bring out new facts and discoveries. Again, new localities are being found, and in fact, the public has as yet only tasted of the good things of Commentry and Florissant, the richest known fields in the world, respectively, for carboniferous and tertiary insects. When Brongniart tells us that he has six hundred cockroaches alone at Commentry, we may well hold our breath, and it is not to be believed that he will delay. longer than he is compelled by the very richness of his field, the publication of the results of his study on the other insects whose classification has already been outlined by him. As to Florissant and our other tertiary fields, the work of illustrating the insects, for which thousands of drawings are already made, has, owing to unavoidable engagements, marched far ahead of text; but a volume, with descriptions of over five hundred insects, including mainly the lower orders, and with over eight hundred figures, is nearly ready for the printer. It will show that Florissant alone is as productive as all the tertiary fields of Europe taken together, if we exclude the insects found in amber. Yet during the

past summer, in explorations for the Geological survey, I found that the strata of a considerable tract of country, certainly many, probably hundreds of square miles in extent, lying in western Colorado and eastern Utah, were packed with fossil insects as closely as at Florissant, where they occupy a lake basin of relatively small proportions: whether these new localities will excel or even equal that place in the variety of their fossil treasures, is yet to be determined; but there can hardly be any doubt that we shall soon be able in our western territories to rehabilitate successive faunas as successfully as has been done with many of our vertebrate types, and as has not yet been done for insects in any country in the world. Nor are we confined to our later beds; insect deposits have now been found in a score of places in our extensive carboniferous series, and it is in no way improbable that we may find our own Commentry to double the value of the French discovery. What we really need is a score of trained workers to "go in and possess the land." No one would welcome them more heartily than one who is almost a solitary worker in the American field.

## THE AMERICAN PLUM BORER 'EUZOPHERA SEMI-FUNERALIS' WALK.

BY STEPHEN ALFRED FORBES, CHAMPAIGN, ILL.

Although various boring insects have occasionally attacked the plum, these have been species whose principal injuries are done to other trees, and no distinctive plum borer has hitherto been known in this country. Among these incidentals enemies are the peach borer (*Sannina exitiosa*) the flat-headed apple-tree borer (*Chrysobothris femorata*) the so-called pear-blight beetle (*Xyleborus pyri*), and one of the twig borers (*Elaphidion villosum*). Somewhat recently a newly imported European bark beetle, *Scolytus rugulosus*, has attacked a variety of fruit trees, the plum among them, but by none of these insects has any constant and serious injury been done to the latter fruit, so far as I am now aware. In a species first described (in this country) in 1887, and whose immature stages have remained unknown until the present time, we have our first example of a borer devoted, so far as now known, to the plum alone.

This species was first reported to me as injurious 21 August 1887, in a letter from Farmingdale, Sangamon county, Illinois, accompanied by a few borers found in young Chinese plum trees (*Prunus simoni*), one of which was nearly killed by them.

The attack was described as most general near the forks of the trees, especially at the bases of the lower limbs, but the larvae were sometimes found an inch, or less, within the earth. The

smaller ones were near the surface of the bark, sometimes just under the thin outer film; but others were next the wood. As many as fifty were taken from a single tree, the bark here being killed in large irregular patches.[1]

Living borers received 3 November were about half an inch in length, of a greenish dusky color, with only a few scattered hairs springing from small dark specks. The head was reddish brown, with a darker triangular patch in the middle, and the top of the first segment behind the head, the cervical shield so called, varied from yellowish to pitchy, more or less shaded with brown, but with a median yellow patch. This borer has, of course, the three pairs of legs and the fleshy prolegs (ten in number) of the caterpillar. From the peach borer, whose structure is similar, it may be distinguished by its dusky color (the other being white), its smaller size when full grown, and, with a glass, by the hooks on the prolegs. In the peach borer the ends of the soft stump-like prolegs are provided with small brown hooks, arranged in two opposite curves discontinuous at their ends, each of a single row; while in the new plum borer the corresponding hooks form a complete ring, nearly covering the end of the leg.

Kept in a breeding cage and supplied with the chips and twigs of the plum trees, our larvae spun small webs in which they passed the winter. By 3 May a part of them had pupated, and 28 and 29 May two winged moths[2] emerged, all the others failing.

These moths were small grey insects, the extended wings measuring about eight-tenths of an inch. The fore wings were reddish behind (within); the hind wings were plain.

Other moths of this species were taken several times at the electric light in 1886, 1887, and 1888, the dates o their occurrence ranging from 5 May to 24 August. The greater part, however, were collected in May and June, and this is doubtless the period of the greatest prevalence of the winged form. The time and place of oviposition are unknown.

In brief, the species is apparently single-brooded; passes the winter as a larva in the tree; pupates in May; emerges in May and June, and may continue to lay eggs through July and August.

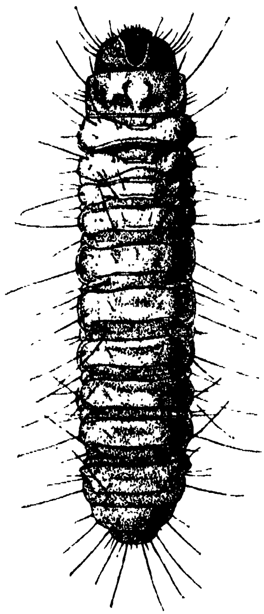
DESCRIPTION.

*Larva.*—The general appearance of this larva is that of a dusky somewhat hairy caterpillar, paler beneath, with reddish brown head, darker in the middle, and variegated cervical shield. Principal hairs conspicuously long and slender. The head is brown, with a lateral black blotch behind the eyes, smooth, much darker on the slightly depressed frontal area, this bordered by depressed black sutures, outside which, at a little distance, is a V-shaped fine

[1] I have found mention of the larval habits of only two other species of this genus (both exotic), one (*E. cinerosella*) living on wormwood (*Artemisia*), in Europe, and the other (*E. zellerella*) bred from dates.

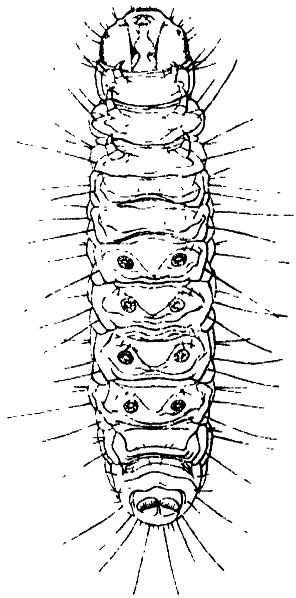
[2] Determined as above by Prof. C. H. Fernald.

white line. *Antennae* three-jointed; first joint very large, broadly conical; second thick, oval, with a very long stout hair at outer side of tip; the third minute. *Ocelli* five, black, placed behind the antennae in a curve opening downward.



*Labrum* broadly emarginate, with rounded lobes. *Maxillae* and *labium* pale beneath, with dark sutures strongly contrasting with adjacent parts of the head. *Mala* and *palpi* brown. *Labial palpi* minute. *Maxillary palpi* three-jointed, large; first joint nearly as thick as the *palpiger*, and about as broad as long; second joint cylindrical, width two thirds the length; third joint tapering, about two thirds as long as the second.

Body with six conspicuous rows of long pale hairs, longest on the posterior segments, one hair of each row to each segment, each borne on a minute black piliferous tubercle scarcely as large as the spiracle. One row above spiracles, another equally distant below, and two subdorsal rows. Other smaller hairs irregularly distributed.

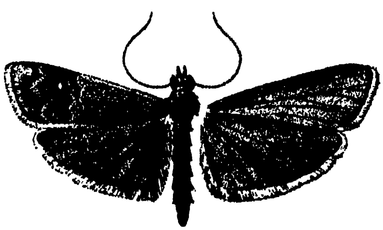


*Cervical shield* yellow, smooth, with a few scattered hairs and two curved brown blotches, one on each side, separated by a yellow median spot. *Anal plate* coriaceous, brown, heart-shaped, with six long stout hairs at its posterior margin. Posterior segments without

spines or tubercles at hinder margin, differing here from the peach borer. Spiracles black, nearly circular, anterior pair but little larger than the remaining eight, last pair not exceeding the eighth in size.

*Thoracic legs* pale reddish brown externally, paler within, with dusky tips. Each proleg except the last pair with a complete close circlet of large hooks, and several smaller ones besides, and also a horny black central disk or tubercle within the ring. Last pair with a single half circlet of very strong close-set hooks.

*Imago.*—Expanse 20 to 25 mm. Head and thorax dusky gray with bright bronze reflection. Abdomen similar, and also brightly bronzed, but with edges of segments pale. Fore wings light gray, with brownish red and black markings. Posterior two thirds of basal field brownish red, with scattered reddish scales along the costa also, the reddish tint deepest along the middle of the wing. Basal line near



the middle of the wing white, sometimes obsolete posteriorly, making, when complete, two external and three internal angles. Middle field black mixed with gray except at posterior margin, where it is largely suffused with reddish brown. White scales usually forming distinct discal spots, in one case broadly ringed with black. Outer line variable; when distinct, with two internal and one external angles. Commonly distinctly bordered with black within, and followed without by a reddish shade (except near costa, where this merges in black, which is broadly bordered by light gray). A marginal black line, commonly broken by veins. Fringe dusky, with white line at base. Hind wings smoky, with black marginal line and dusky veins, and fringe with white basal line followed by a dusky band, beyond which it is paler. Surface of hind wings considerably bronzed, the fore wings less so. Beneath, wings fuscous bronzed. Outer field of fore wings somewhat paler, hind wings gradually darkening outward.

Antennae dark; proboscis gray; palpi dusky bronzed.

Described from twelve Illinois specimens.

Distribution; Colombia, S. A. (Zeller), Florida, Texas, Colorado, Utah, Washington. Pretty general throughout the eastern United States and Canada.— Hulst.

LITERATURE.

The species was first described in 1863 as *Nephopteryx semi-funeralis* by Walker in the British Museum catalogue, part 27, p. 58; and again in 1882, according to a note kindly sent me by Mr. Hulst, as *Euzophera impletella*,

Zeller,[1] this description being based on specimens from Colombia, S. A. In this country it was described by Hulst in 1887 in Entomologica Americana (v. 3 p. 137) as *Stenoptycha pallulella*.

The original description of the genus was given by Heinemann under the name *Stenoptycha*, in 1865, in his work on the lepidoptera of Germany and Switzerland,[2] but as this generic name

1 Hor. Soc. ent. ross., 1882, v. 16, p. 224.

2 Die schmetterlinge Deutschlands und der Schweiz, 1865, p. 190.

was preoccupied by Zeller,[1] the genus was rechristened *Melia* by Heineman, on a later page of the same work.[2] *Melia* proved, however, also to be preoccupied[3] as noted by Zeller in 1867, and the current *Euzophera* was then finally proposed.

1 Entom. zeitung Stettin, 1863, p. 154. Zeller's use, of this name for a genus of *pterophoridae* is also illegitimate, as it has already been applied by Agassiz to a Medusa (Contr. nat. hist. United States, 1862, v. 2, p. 149)

2 *l. c.*, p. 209.

3 Used previously in *muscidae*, *pyralidae*, crustacea, mollusca and botany.

4 Entom. zeitung Stettin, 1867. p. 377.

## DESCRIPTIONS OF SOME NEW NORTH AMERICAN MOTHS.

BY WILLIAM BEUTENMÜLLER, NEW YORK.

### DATANA MODESTA, n. sp.

Head and thoracic patch yellowish ochreous, remaining parts of thorax rusty brown. Primaries rusty brown with a small, elongated, discal spot on the middle of the wing and another smaller spot before the middle. About the apical fourth of the wing is an ill-defined, transverse, curved band a little darker than the ground color. Beyond this band the wing assumes a purplish brownish color. Secondaries much paler than the primaries. Body above yellowish ochreous, beneath pale ochreous. Secondaries beneath pale ochreous, primaries somewhat darker. Expanse 48 mm. 1 ♂. Hab. Kissimmee, Florida, May, Type Collection, Chas. Palm.

Allied to *D. floridana*, but differing from it by having the thoracic patch yellowish ochreous, and by the absence of the two additional transverse bands.

### DATANA PALMII, n. sp.

Head and thoracic patch deep velvety brown, remaining parts of thorax cinnamon brown, mixed with whitish scales. Primaries cinnamon brown (in one specimen nearly as deep in color as *D. angusii*) and thickly covered with whitish scales so as to nearly obscure the ground color. Across the wing are four narrow, transverse bands same as the ground color. The first on the basal fourth, oblique; the second a little before the middle slightly curved; the third a little beyond the middle and

the fourth on the apical fourth, both these bands are curved outwardly. Secondaries pale cinnamon brown. Primaries beneath same color as the secondaries above. Secondaries beneath ochreous. Expanse 48 mm. 4 ♂♂. Hab. Delaware Water Gap, Penn. June. Collected by Chas. Palm to whom I gratefully dedicate this odd species.

Allied to *D. integerrima*, from which it can be distinguished by the absence of the two discal spots, different position of the bands and also by the different color.

Both the foregoing species were compared with the types of allied species.

ORGYIA INORNATA. n. sp.

♂ Body above and below fuscous, pectinations of antennae blackish, stalk grayish. Primaries uniformly fuscous with a curved, transverse band beyond the middle, bending inwardly as it reaches the inner margin. Secondaries fuscous. Wings beneath somewhat paler than above. Expanse 15 mm.

♀. Wholly dirty whitish above and below. Length 16 mm. Width 7 mm. 1 ♂. 2 ♀♀. Collection W. Beutenmüller. Hab. Enterprise, Fla. May.

Differ from all its congeners by the absence of the ante-apical white spot near the inner angle, and by its plain coloration.

LARVA.—Head and cervical shield bright coral red. Body above mouse color with three rows orange tubercles along each side. Each tubercle provided with a bunch of long, silvery gray hairs. Along the subdorsal region of the second, third, ninth, tenth, eleventh and twelfth segments is also a row of orange tubercles with silvery gray hair while on the dorsum of the fourth, fifth, sixth and seventh segment is a thick bunch of white hairs and from the eighth segment to the end of the body there is a broad, black stripe, with three small orange spots on each segment. On each side of the anterior parts of the first segment is a long, black pencil and one on the eleventh segment which is brown at the base. A few brown hairs are also scattered here and there over the body. Underside yellowish green. Length about 30 mm.

FOOD-PLANTS. Live oak (*Quercus virens*), and cypress (*Cupressus*).

COCOON.—Similar to that of *O. leucostigma* light brown, oval, composed of fine silk, interwoven with the hair of the larva. Length 25 mm. Width 12 mm.

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ENTOMOLOGICAL SOCIETY OF LONDON.—At the meeting of the Entomological society of London held 7 August 1889. Dr. C. V. Riley was elected an honorary fellow in place of the late Dr. V. Signoret. The number of honorary fellows is limited to ten, and less than forty of the most celebrated entomologists in the world have been thus honored. Dr. H. A. Hagen was elected in 1863, Dr. J. L. Leconte in the same year and Dr. A. S. Packard in 1884.

Classified according to the land of their birth there are but two Americans, Drs. Leconte and Packard.

Prof. C. H. Fernald was elected a fellow at the meeting held 4 September 1889.

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No. 160-164 were issued 2 Jan. 1890.

PSYCHE

A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 166.**

FEBRUARY 1890.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c

[Entered as second class mail matter.]

PSYCHE.

# SYNOPSIS OF THE ODONATA OF NORTH AMERICA, NO. 2. THE GENUS ANAX.

BY HERMANN AUGUST HAGEN, CAMBRIDGE, MASS.

1. ANAX LONGIPES.

*Anax longipes*, female, Hagen Synop. Neur. N. A., 1861, 118, 2; Stett. ent. zeitung, 1863, v. 24, 373, 52; Verhandl. Wien zool.-bot. ges., 1867, v. 17, 35; Proc. Bost. soc. nat. hist., 1874, v. 16, 350, 2; Synop. Odon. N. A., 1875, 32, 2.—Brauer Reise österr. freg. Novara, 1866, bd. 2, 60, 3.—Male, M'Lachlan Ent. mo. mag., 1874, v. 10, 227; 1883, v. 20, 129, 171.—Hagen, *op. cit.*, 1883, v. 20, 169.

Male (living), eyes dark reddish brown; head, thorax, base of abdomen green; abdomen beautiful brick red; front green; without any spot above; vertex, antennae, occiput black; eyes behind with a very large elongated green spot; thorax beautiful green; legs black, femora yellow, the articulation with the tibiae and the inside of the anterior femora black; posterior tibia 12 mm.; posterior femur 16 mm.; hind legs reaching beyond the fourth segment; abdomen with the two basal segments inflated, green; first segment with two brown spots on the basal thoracical impression; second segment with a transversal dark median stripe, a darker anteapical spot and two round apical reddish green spots; the transversal median stripe is interrupted in the middle by a granulose somewhat triangular plate; the following segments of a beautiful brick-red, segments 3 to 5 with a brown triangular apical spot, less marked in 6, and a triangular basal brown spot on 4 and 5; all of these spots disappear in the dead insect, and the color of the abdomen becomes an indifferent reddish brown; last segment above with a narrow impressed rim at the middle of the base; appendages brick-red; the superiors as long as the two last segments, straight, narrow, cylindrical at base; along the external margin with an elevated keel ending in a short spine on the apex; a large basal excision internally; the inner margin of the following part is also slightly excised; inferior appendage very short, narrowed to tip, with two apical black tubercules above; on each side of the second segment below there is a small pointed spine on the basal plate near the margin of the genitals.

Wings hyaline, venation black, costa yellow, pterostigma narrow, yellow;

membranula black, white at base; antecubitals 17—19, postcubitals 8—10.

A male from Haulover, Fla., 3 March, though of a slightly smaller size, is not different. One from Haiti also of a similar size differs by the unfinished color of the occiput (it is somewhat livid) and by the presence of a yellowish tinge in the middle of the hind wings. Three males from Mexico are a very little smaller, but do not differ except that the femora are very dark brownish red, the pterostigma a little darker and there is a yellow tinge in the middle of the hind wings.

Female (living), head, thorax, legs and the two basal segments of the abdomen as in the male; eyes blue, the hind margin of the occiput on each side yellow; second segment with a transversal brownish median stripe on each side; a darker anteapical spot, and two apical blue ones; abdomen from the third segment brown, segments 3—9 with two apical blue spots, segments 3—7 with two basal blue spots, and segments 4—6 with two intermediate blue spots; appendages light brown, as long as the two last segments, lanceolate with an elevated keel to the tip, which is not sharply pointed; wings as in the male; 19 antecubitals, 9 postcubitals.

Two females from Florida are a little smaller, the color and pattern are similar, the last segment is light brown.

Race CONCOLOR.

*Anax concolor* Brauer Reise österr. freg. Novara, 1866, bd. 2, 66, pl. 1, f. 15, app. ♂.—Hagen Synop. Odon. N. A., 1875, 38, 2.

Male, though a little smaller it is entirely similar to *A. longipes*, except the color of the abdomen, which for segments 3-10 is not red but dark brownish-black with the pattern of large spots just as in the female; color of these spots yellowish; the two basal segments in color and sculpture as in *A. longipes;* appendages red, occiput more livid; wings as in *A. longipes;* antecubitals 15-19; postcubitals 8-9; the abdomen also is similar to that of the described living female; the blue spots are retained perfectly in the dead specimen.

| | Longipes ♂ | | | | Concolor ♂ |
|---|---|---|---|---|---|
| | Mass. | Fla. | Haiti. | Mexico. | Brazil. |
| Length. | 85 | 79 | 74 | 72 | 70-74 |
| Abdomen. | 58 | 55 | 53 | 50 | 50-53 |
| Appendages. | 6 | 6 | 6 | 6 | 6 |
| Exp. wings. | 110 | 102 | 102 | 100 | 92-95 |
| Hind wing. | 53 | 51 | 51 | 48 | 44-48 |
| Pterostigma. | 6 | 6 | 5 | 5 | 5 |

| | Longipes ♀ | | Concolor ♀ |
|---|---|---|---|
| | Mass. | Fla. | Brazil. |
| Length. | 86 | 76-73 | 76 |
| Abdomen. | 60 | 56-52 | 54 |
| Appendages. | 6 | 6-5 | 5 |
| Exp. wings. | 114 | 103-99 | 100 |
| Hind wing. | 56 | 51-49 | 48 |
| Pterostigma. | 6 | 6-5 | 5-4½ |

HAB. Georgia, Abbot, a male in the Museum of science and art, Dublin; a female (my type) in the collection of Escher Zollikofer, now in the University museum in Zurich, Switzerland; two males and one female collected by myself, 25 August, 1875, at Woods Holl, Mass.; a female (not seen by me) collected by Mr. P. R. Uhler, in 1875 near Baltimore, Md.; a female collected by Mr. R. Thaxter in 1875 in Florida, and

a pair collected by Mr. H. G. Hubbard 3 March, at Haulover, Florida; two males Jalapa, Mexico and one male Amula, Guerrero, Mexico, 6000 ft. August, Mr. H. H. Smith; one male collected by Mr. W. Cabot, 14 February, 1884 in Haiti; var. *concolor* three males, one female collected by Mr. H. H. Smith at Matto Grosso, Brazil; one male, type of Brauer (not seen by me), near Rio Negro, Brazil. I am glad to record 19 specimens of this species, which has been considered very rare. When I described *A. longipes* only the female was known, and when Mr. Brauer described *A. concolor* but one male was in his hands. The number of males now before me makes it certain that *A. concolor* is only a southern race of *A. longipes*, having the pattern of the abdominal spots of the female also preserved in the male. I confess that a similar race of an *Anax* or of an *Aeschna* is unknown to me, but the exact identity of all other characters agrees well with my opinion. The splendid brick-red color of the living male may perhaps be variable, as I have seen but two males alive. It is remarkable that both the male caught by myself and the female caught by Mr. Thaxter had captured a *Papilio asterias*, had cut off the head of the same and were ready to devour their prey when caught themselves.

Mr. W. Cabot also brought from Haiti some nympha skins which probably belong to *A. longipes*. They are of the size of *A. junius* but are red. I am not able to make out any specific difference.

Mr. L. Cabot, Mem. mus. comp. zool. v. 8, p. 17, has described the supposed nympha of *A. amazili*, from Jamaica; he now believes this to be identical with the nympha from Haiti, supposed to belong to *A. longipes*.

2. Anax junius.

*Libellula junia* Drury Ill., 1770, v. 1, 112 pl. 47, f. 5.

*Aeschna junia* Burm. Handb., 1839, v. 2, 841, 18.—Say Journ. Acad. nat. sci. Phil., 1839, v. 8, 10, 2.—Ramb. Nevr., 1842, 196, 6.

*Anax junius* Selys Rev. Odon., 1850, 328.—Sagra Ins. Cuba, 1856, 458.—Hagen Synop. Neur. N. A., 1861, 118, 1; Stett. ent. zeitung, 1856, v. 17, 369; 1860, v. 21, 213; 1863, v. 24, 373, 51; Verhandl. Wien zool.-bot. ges., 1867, v. 17, 33; Proc. Bost. soc. nat. hist., 1868, v. 11, 291; 1873, v. 15, 271, 28; 1874, v. 16, 350, 1; Synop. Odon. N. A., 1875, 32, 1.—Brauer Reise österr. freg. Novara, 1866, bd. 2, 61, 10.—Walsh Proc. acad. nat. sci. Phil., 1862, 397.—Cabot Mem. mus. comp. zool., 1881, v. 8, 15, 4, pl. 1, f. 2.

*Anax spiniferus* Ramb. Nevr., 1842, 186, 4, pl. 1, f. 14.

Head and thorax grass green, abdomen ultramarine blue (male), obscure pale purple or lilac (in the living female)[1]; front above with a round black spot with a circular dark blue band around; feet black, femora rufous; first segment and the base of the second

[1]These colors of the living insect were given to me by the late Benj. D. Walsh.

green, with the transverse elevated rim not interrupted, but united with the opposite one at a right angle; a dorsal fuscous fascia, interrupted and partly angulose on the abdomen after the basal segments; male appendages dark fuscous, straight, enlarged towards the apex, with an internal excision on the tip and a sharp external apical spine; inferior very short, quadrangular, transverse; those of the female lanceolate; wings hyaline, flavescent or not in the middle; costa yellow, also the narrow pterostigma; membranula black, white at base; antecubitals 16 — 19, postcubitals 7—9.

| | |
|---|---|
| Length, | 68-78 |
| Exp wings, | 104-116 |
| Pterostigma. | 7 |

HAB. St. John, New Brunswick, August; Canada, St. Hyacinth, Quebec, Provancher; Hamilton, Ontario, end of August, Moffat. United States: Mass., Magnolia, Milton, Brookline. — N. Y., N. J., Pa., Philadelphia.—Md., Kent., S. C., Geo., Fla., Mo., La., Tex., Ill., Mich., Minn., Dak., Nev., Cal., Or. The Dalles, June.—N. Mex., Ariz., Alaska, Sitka.

Mexico: Matamoras, Jalapa, Amula 6000 ft.—Costa Rica.

Antilles: Cuba, Poly; Martinique.

China: Petcheli Bay, April, Osten Sacken; Kamtschatka.

Sandwich Islands: Oahu, Honolulu, Taiti (Selys).

I have described as *A. strenuus* a female, now in the Copenhagen museum, from Oahu, collected during the circumnavigation of the GALATHEA. The only difference from *A. junius* consists in the shape of the occiput (the lateral lobes being longer, more elevated and quadrangular) and in the gigantic size. Length, 94 mm., exp. of wings, 136 mm. The specimens of *A. junius* from Oahu are all very large, but the size of this giant is entirely unusual. I have before me a number from Oahu but none of them similar in size.

3. ANAX WALSINGHAMI.

*Anax walsinghami* M'Lachlan Ent. mo. mag., 1883, v. 20, 127, 171.

*Anax validus* Hagen Synop. Odon. N. A., 1873, 32 (no description); Cabot Mem. mus. comp. zool., 1881, v. 8, 15.

Head yellow, front with a round black spot in a blue ring, anteriorly bordered with a fine black line; vesicle black, transversely yellowish above; antennae black, seta brownish; occiput yellow, emarginate; head behind yellow, with a superior narrow blackish margin; thorax green; feet black, femora reddish brown, the anterior yellow beneath; length of the posterior femora about 14 mm; abdomen very long (male), especially segments 5—6, shorter in the female; blue at base, suture of second segment interrupted at the middle, a dorsal blackish band, beginning on the fifth segment and finishing on the ninth with an apical elongate blue spot on each side, and a basal whitish one on segments 8 and 9; the last segment as broad as long (male) blue, margin black and irregularly black on the dorsal line; superior appendages of the male, short, broad, brown, flattened and foliaceous, upturned on the

apex; in front of the appendages a deep excision forms a strong, long tooth; inferior appendage one half shorter, slightly longer than broad, shallowly excised on the tip. Appendages of female short, oval. Wings large, hyaline, neuration black, costa yellow, pterostigma short, brown; membranula black, white at base; antecubitals 19—16; postcubitals 10—8.

| | Male. | Female. |
|---|---|---|
| Length, | 105 | 95 |
| Abdomen, | 85 | 77 |
| Exp. hind wing. | 125 | 120 |

HAB. California, San Diego.

This species was discovered by the late G. R. Crotch in 1872. He gave two splendid couples to the Museum of comp. zool. Later several specimens were collected in northern California by Lord Walsingham; the collection of the Museum has two males from Tucson, Arizona. An incomplete male (not seen by me) from Guatemala is in M'Lachlan's collection. Mr. L. Cabot in "The immature state of the odonata. Part 2. subfamily *Aeschnini*" 1881, p. 15, mentions some nymphae from San Diego, California, more bulky than *A. junius* and with two black teeth in the middle of the comb of the front border of the mask and another large nympha from New Mexico. It was believed rather doubtful that nymphae so similar to those of *A. junius* should belong to the gigantic and very different *A. validus* (=*walsinghami*). After a new and detailed study of this subject I think these nymphae may belong to *A. walsinghami*.

4. ANAX AMAZILI.

*Aeschna amazili* Burm. Handb., 1839, v. 2, 841, 19.

*Anax maculatus* Rambr. Nevr., 1842, 188, 7.

*Anax amazili* Hagen Synop. Neur. N. A., 1861, 119, 3; Verhandl. Wien zool.-bot. ges., 1867, v. 17, 38; Synop. Odon. N. A., 1875, 32, 4; 38., 1.—Brauer Reise österr. freg. Novara, 1866, bd. 2, 61, 9.

The color of this species is black and and green but the green is not so beautiful as in *Lepthemis vesiculosa* Fabr. This note is by Mr. Veilenmann and made from specimens collected by him in Pernambuco, Brazil. My description in the Synopsis is made from Professor Burmeister's types.

HAB. Guatemala; Cuba; Barbados; Porto Cabello, Venezuela; Amazon, Para, Pernambuco, Rio, Brazil.

There are on the whole continent of America only four species of *Anax* known. The gigantic size and brilliancy of their colors makes it rather improbable that any new species will be found, but of course it is not impossible. Of the four species *A. junius* is strictly North American, passing down a short distance to the Isthmus and the Antilles. This species is apparently introduced into the Sandwich Islands, where its size is larger, and in the north in China and Kamtschatka.

*A. longipes* is a South American species, passing along through the Antilles and Florida and, favored by the Gulf stream, to southern Massachusetts.

*A. walsinghami* is a North American

species, found west of the Rocky Mountains, extending south to Guatemala.

*A. amazili* is strictly a South American species extending to the north to the Antilles and Central America.

There are two species in Australia, three in Europe, four in Africa and perhaps ten in Asia.

## THE ARGYNNIDES OF NORTH AMERICA.

BY HENRY JOHN ELWES, CIRENCESTER, ENGLAND.

[Reprint, p. 563-575, from "A revision of the genus Argynnis," (Trans. ent. soc. London for the year 1889, p. 535-575.)]

The Argynnides of North America are, without exception, the most difficult butterflies to classify that I have ever studied. I have a collection which includes authentically named specimens of almost all the species and varieties, many of them direct from such well-known collectors as Messrs. H. Edwards and Morrison ; many from Messrs. Strecker and Geddes. I have also seen some of the best collections in the United States, and studied all, or almost all, the large mass of scattered literature and notes on the genus by Messrs. W. H. and H. Edwards, Mead, Geddes, Scudder, and Strecker. I have repeatedly tried to construct a key by which the supposed species could be identified, and can only say that I have completely failed. I am certain that no entomologist, who received to-day the most perfect collection which could be got together from all parts of North America, and had to classify and describe them without regard to the works of others, would make anything like as many species as have been recognized. It seems presumptive for a man to set aside much of what has been written by those who have seen, both living and dead, so many more specimens than I have seen, and yet I cannot, in dealing with the American forms, adopt as specific, characters so slight and variable that they would not be recognized as such in the much better known European species. And to show that it is not my ignorance alone which makes the difficulty, I may say that it is just those species which I have personally observed in life, and which I have most carefully examined, such as *A. eurynome*, *A. liliana*, *A. monticola*, and *A. meadii*, in which I have found my uncertainty the greatest. Mr. Strecker's remarks, on p. 118 of his Catalogue, are so much to the point that I will quote them here, and can only say if our American colleagues do not agree with them, let them rather point out how others may under-

stand their conclusions, than blame me for not adopting what I cannot see:—"The Argynnides of the western slope, or Pacific side of the Rocky Mountains, are without doubt, if we except, perhaps, the Coliades, the most difficult of all the North American Diurnae to deal with, as they not only run into certain variations, but again into subvariations, or even further. The two species *monticola* and *zercne*, first considered identical by Dr. Boisduval, are perhaps the most perplexing; each of these bears the same relation to some of their varieties as does *niobe* to its var. *eris* and *adippe* to *cleodoxa*, but presenting by no means the stability of forms of these European variations, but branching out into endless and endless varieties until the student is completely at a loss to know where or to what they may belong."

Scudder, in the 'Butterflies of New England,' has figured the abdominal organs of several species of *Argynnis* on plate 33 which gives an opportunity of comparing some nearly allied species. Those of *A. cybele*, fig. 44, *A. aphrodite*, fig. 40, are very similar indeed, but as they do not appear to agree exactly with the descriptions, and the figure of that of *aphrodite* is not alluded to in the description on p. 565, I do not know whether the description was made from the same specimens figured, and whether we are to attribute the difference to variation, or to incorrect drawing. The clasper of *atlantis* fig. 36, also much resembles those of *cybele* and *aphrodite*, but has the hook longer and nearer the clasp. The figure of the androconia of these three species, plate 46, figs. 12, 13, 14, are also very similar, and, taken in connection with the claspers, do not lead one to suppose that very much help will be given in deciding the relationship of nearly allied species in this genus by a microscopic examination. The claspers of *A. myrina*, *bellona*, and *montinus*, plate 33, figs. 35, 38, 42, all included by Scudder in the genus *Brenthis*, show a general similarity of form *inter se*, with the same minor differences as those of *cybele*, *aphrodite* and *atlantis*. I at first supposed that some difference might be found in the scales clothing the median veins in the males, but on examination with a powerful lens *idalia* is the only North American species in which the raising is conspicuous, though in some specimens of *atlantis* and *aphrodite*, and others, it is clearly perceptible. The tuft of silky hairs on the subcostal nerve is present in the males of all the larger species that I have examined, and is very conspicuous in *idalia*, but I have not found it in the smaller species which have been separated under the genus *Brenthis*.

*A. idalia* and *A. diana* are two of the most beautiful species in the whole genus, and may be said to form the best links between those species of Eastern Asia, which end the Palaearctic series, and the American species, which are isolated from them. *A. diana* has the sexes more different than any except *sagana*, and if the genus was divided into groups would be another instance of an American species having its

nearest affinities in Northeastern Asia and Japan, of which we have several among the plants of the Alleghany Mountains.

*A. aphrodite*, *A. cybele*, *A. alcestis*, *A. cypris*, *A. halcyone*.— This is a group of species or forms which are extremely hard to define, and though Edwards and Scudder, and most other North American entomologists, agree in keeping them separate, I think it is very difficult, if not impossible, to identify them unless you know their habitat. I have a pretty good series of all except *cypris*, which must be very close to, if not identical with, *alcestis*, and judging by the character of the median veins in the fore wing of the male, by the color and pattern of the under side, which are the best characters I know by which to define the species, I am certainly inclined to follow Strecker rather than Edwards. There have been so many mistakes made in identifying these species by collectors that their geographical distribution is not very easy to follow out; though Mr. Scudder's maps are useful, they are by no means infallible, and the northern and western range of *aphrodite* and *cybele* is certainly not defined at present. I received from Morrison a pair of *cybele* from Montana, which agree with those taken by Geddes in the Northwest Territory of Canada, near Edmonton, being smaller than those from the eastern states. According to Scudder and Edwards, however, *cybele* does not occur in Montana, and the Edmonton habitat is quite isolated; whilst *aphrodite*, which is unmentioned by Geddes in his lists of north-western butterflies in *Canadian entomologist:* vols. 15, p. 221, 16, p. 56 and 224, is stated by Scudder and Edwards to occur at Edmonton. Either such experienced collectors as Morrison and Geddes did nor know *aphrodite* when they saw it out of its usual range, or Scudder and Edwards are mistaken. Though it seems undoubted that typical eastern specimens of these species can be distinguished (for the points of difference see Scudder, p. 566), yet the differences are so slight that it may not be possible to identify western specimens with one or the other, and this difficulty seems to have been got over in Edwards' case by creating other species, such as *alcestis*, *cypris*, and *halcyone*, which cannot be identified with any certainty from his figures or descriptions; and which, notwithstanding all that has been written upon them, must remain, as far as I can see, "species dubiae" to those who have not specimens identified by their author at hand for reference.

*A. leto* is a species which, though undoubtedly nearly allied to *cybele*, is fully as distinct from it as *nokomis*, and may be regarded as its Pacific coast form, in the same way as *nokomis* is the form of the dry central plateau of the continent. Though the male is not very different from the male of *cybele* yet the female, which on the upper side is hardly distinguishable from the females of *nokomis* and *notocris*, is marked by the strong contrast between

the deep chocolate, almost black, of the base and inner area of the wings and the pale yellowish color of the area. Its range extends along the Pacific coast from Central California to Washington Territory, and it is recorded also by Geddes from Fort Macleod, in the Northwestern Territory of Canada, on the eastern side of the mountains. Those I have from Washington Territory are considerably darker at the base of the hind wings than others from Plumas county, California; and I should not be at all surprised if a large series from different localities were to show forms intermediate both with *cybele* and *nokomis*.

*A. carpenteri* is unknown to me, except from the description, which seems to point to a form of *cybele*. It was described from two males and one female taken by Dr. Carpenter in New Mexico at a high elevation above the timber line, and is said by Mr. Edwards to be of the size of *atlantis* and near *cybele*.

*A. nokomis* and *nitocris* are regarded by Mr. Edwards, in his last catalogue, as distinct; he cites, however, Strecker's figure of *nokomis* female, in Ruffner's report, as an aberration of *nitocris*. This is just one of those cases which prove how difficult it is to follow Edwards's authority in such matters. It so happens that I have two excellent pairs of *nokomis* from Arizona, sent by Mr. H. Edwards, which exactly agree with Mead's figure cited by Edwards. I have also a pair of *nitocris*, the male from Utah, sent by Mr. Strecker, the female from Arizona, agreeing with it, so marked by Mr. H. Edwards. "I think this species passes as *A. nitocris*, female." It differs from *nokomis* in having the under side of hind wing to the second row of spots cinnamon-color, as in *cybele*, and is exactly intermediate between *nokomis* and *leto*. The specimen figured by Strecker in Ruffner's report, and cited by Edwards as an aberration of *nokomis*, is, to my eye, much more like *leto* than it is to *nitocris* or *nokomis*; and Mr. Strecker's remarks are as follows:—"The present two examples from Colorado differ notably from all those from Arizona in the following particulars: On under surface the red color of primaries is darker, and covers evenly the whole wing except toward and at the apex; on the secondaries the whole space interior to the second of the two outer rows of silver spots, which in the Arizona examples is powdered greyish green, is deep reddish brown, nearly of the same color as in the female *aphrodite*, or the male of *leto*; they are larger than most of those I have seen from Arizona. On the upper side it presents no differences. I have always contended that *nokomis* was a pale abnormal form of *cybele*, of which we have so many other instances in the species from the dry salt regions of Utah and Arizona, and these intermediate examples from Colorado, with their dark reddish under sides, seem to strengthen my opinion. I can but regret that no males were captured (unless the following be really its male)*, as I consider this is

*This is put down as *cybele* by Mr. Strecker, who is astonished at receiving it from Colorado, and is strongly

by far the most interesting insect in the whole collection."

*A. aphrodite* is a very wide-ranging species, which varies enough in the Western States to have received at least three names, for I cannot see how to distinguish *alcestis* or *halcyone* in the perfect state, though Edwards says the larva of *alcestis* is different, and places *halycone* in a different subgroup with *coronis*, *calippe*, and *edwardsi*, on account of the larger and more egg-shaped form of the silver spots on the under side. When, however, a good series is compared together (I have sixteen males and twelve females of this group from various States), I cannot see that his supposd distinctions are constant, and though *nausicaa*, of which I have four males and five females, taken by Messrs. Hulst and Morrison, is distinctly of a deeper red on the upper surface than any of the rest, yet its under side, like that of *halcyone*, has nothing sufficiently marked to distinguish it. Mr. Edwards perhaps would say that my *halcyone*, which were sent by Mr. Strecker, and taken near Denver, are not true to name; but what else can they be from that locality? It only shows that if a describer of insects does not make his descriptions sufficiently comparative and clear to be followed by others, he must not be surprised if others refuse to accept them. Larval characters alone, which are liable to vary like those of the perfect insect, and which cannot be easily compared by others, are not in my opinion sufficient.

With regard to *A. nausicaa*, however, I see a point not alluded to by Mr. Edwards, which may be sufficient to separate it, namely, the much less abundant and shorter tuft of hairs on the subcostal vein of the hind wing in the males. This tuft is prominent in all males of *aphrodite*, *alcestis* and *halcyone* which I have examined; in *nausicaa* it is much less conspicuous, and, taken in conjunction with the isolated habitat and deeper color, is probably enough to distinguish it.

*A. atlantis* is another species which I find it uncommonly difficult to decide about, not so much when the eastern form alone is before me, but when the numerous western species or forms have to be considered. Mr. Edwards has got over the difficulty by naming them all separately, and Mr. Scudder, though he was not perhaps obliged to mention them in the 'Butterflies of New England,' says nothing as to their very near relationship. He remarks as follows:—"There is no need of confounding this species with either of the preceding [*aphrodite* and *cybele*]: it is smaller than they, duller in tint above, has a blackish border to all the wings in both sexes, and more continuous mesial band on the upper surface of the hind wings; the darker colors of the under surface of hind wings are deeper in hue than in either of them, while the buff belt is wider than that of *aphrodite* and narrower than that of *cybele;* the buff scales on the basal half of the wing also assume more im-

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inclined to the belief that it is the male of the above described form of *nokomis*.

portance than in the other species; finally the costal border of the fore wings does not appear to be quite so much arched. It is possible, perhaps even probable, that this species is the true *Papilio aphrodite* of Fabricius, but as it is quite impossible to be certain of it, the names ought to stand as given by Mr. W. H. Edwards, who first clearly distinguished the species in this difficult group. The species were still confounded in the British Museum, after the publication of Butler's Fabrician butterflies, as I myself saw, and notwithstanding Butler's remarks on p. 108 of that work." Its distribution, according to Mr. Scudder, is much the same as that of *cybele* and *aphrodite*, but extends to Newfoundland, Labrador, and the Hudson Bay Territory; on Mead's authority he also gives Colorado, but Edwards calls the form found here *electa*, which also ranges into New Mexico and Montana. Whether this is the same or not I cannot be certain, as the description of *electa* in 'Field and Forest' is inaccessible; but I have a pair from Colorado, given me by Mr. Holland (which are named *electa*, I believe, by Mr. Edwards), and a female from S. W. Colorado, taken by Morrison, which I cannot separate from *atlantis*. Mead also gives a clue to the correctness of this identification with *atlantis* by mentioning the strong musky odor of the Colorado species, a peculiarity of *atlantis*, to which Scudder calls attention. Geddes says that *atlantis* occurs in all parts of the Rocky Mountains north of the American boundary which he visited, and if this is correct, it can hardly be absent from Montana and Colorado. But at the same time I must say that the male of so-called *electa* does not differ from the female as does another male from Colorado (sent by Mr. H. Edwards as *hesperis*) in having the silver spots of the under side partially obsolete. If, therefore, *hesperis* and *atlantis*, which are placed next to each other by Mead, and stated to occur at the same elevation in Colorado, run into each other, as they seem to do, we are led into the belief that *atlantis* is liable, in the west, to the disappearance of the silver spots, which takes place in other American and European species; and then there is no reason why some of the forms which occur on the Pacific States, such as *columbia* should not also belong to *atlantis*. I do not say that they are so because it would be unwise to do so without knowing them in nature better than I or any living American naturalist does; but on the other hand I can see nothing in the writings and figures of Mr. Edwards to prove the contrary, or to enable others to distinguish them. *A. columbia* H. Edw., was by him considered as so near to *atlantis* that it might be only a variety of it. It was described from four males taken at Lahache, near the Alaskan border of British Columbia, and there is nothing in the description worthy of note; but, when going through Mr. Edwards's collection, I noted it as similar to *hesperis*.

*A. lais*, of which I have seven of the specimens from Red-deer River, from which the species was described, seems to me very near *atlantis*, but separable by the smaller size, paler color, and apparently by the less raised scales of the submedian veins in the male. Edwards, however, says it is of the size of *atlantis*, and stands between that and *aphrodite*. Geddes does not tell us how to distinguish them, but says that it was found on the prairies about Fort Edmonton, while *atlantis* occurred in the mountains.

*A. coronis* is a species which seems to have a very wide range west of the Rocky Mountains, and varies a good deal, but may be recognized in most of its forms by the large ovoid silver spots of the under side of the hind wing. It is apparently most nearly allied to *edwardsi*, with its forms *nevadensis* and *meadii*, but these differ in the longer, narrower shape of the fore wing, and do not seem to be found on the Pacific coast. There occur, however, in Nevada forms which are described as *laura* and *macaria*, of which I have authentic specimens from Mr. H. Edwards, and which, by their under sides, seem to be *coronis;* whilst *chitone*, also sent by Mr. H. Edwards from Nevada, does not agree with W. H. Edwards's description on the under side, and is nearer to *nevadensis*.

None of these names can, in my opinion, be retained except as synonyms, though they are all three kept up in Mr. W. H. Edwards's 1889 Catalogue as distinct species.

Whether *edwardsi*, *nevadensis*, and *meadii* are distinct is a more doubtful question. Certainly *meadii*, which I have taken in the Yellowstone Park, looks very different from the large *edwardsi* of Colorado, but I have some from Montana, taken by Morrison, and from the N. W. Territory of Canada by Geddes, named *nevadensis*, which are perfectly intermediate in size and color; whilst others, sent by Strecker as *nevadensis* from Colorado, resemble *aphrodite* in the color of their hind wings below. Mead says:—"The three closely allied species, *edwardsi*, *nevadensis*, and *meadii* seem to be related to each other in much the same way as the eastern *aphrodite*, *cybele*, and *atlantis*. In *edwardsi* the pale submarginal band below is narrower, and sometimes almost obsolete, as in *aphrodite*, and it ranges up to greater elevations than *nevadensis*, which has this band comparatively broad in both sexes, as we see it in *cybele*. *Meadii* differs from either in tint, especially the female; it is somewhat smaller, and probably, like *atlantis*, is exclusively confined to the mountains. The peculiar bright green coloration of the under side of secondaries in *meadii*, however, has no parallel among our fritillaries."

*A. callippe* is, in its typical form, which occurs all through the lowlands of California, a very distinct species; but *liliana* is, according to Mr. H. Edwards, intermediate between it and *coronis*, and the specimen which he sent me as typical of it does not agree with those which Mr. Godman and I took

abundantly near Los Angeles, some of which Mr. H. Edwards afterwards named *liliana*, though I should certainly call them *callippe*.

*A. semiramis*, again, is a South Californian form, which has been taken by Mr. Wright in the mountains separating the San Bernadino Valley from the Mohave Desert, and of which I have six specimens from him, as it was not yet out when I visited these mountains in May, 1888. To my eye it is nothing more than a form of *coronis*, in which the black markings on the upper side have become paler and more reduced, as might be expected from the arid character of the country where it is found. Edwards says:—"It is curious how the markings resemble two such distinct species as *adiante* (upper side) and *coronis* (lower side)."

The species allied to *monticola*, namely *zerene* and *bremneri*, have puzzled me quite as much as Edwards, Strecker, and others, and I do not see how the difficulties of their synonymy can ever be cleared up; but I can only say that, if I have not succeeded in arranging them correctly, it is not from idleness or carelessness, but on account of the impossibility of identifying species or forms described in such a way as these have been. Many of the names cannot be certainly identified, and had better be dropped. I think, however, that three more or less distinct forms can be recognized among the very numerous specimens which I have from the Pacific States. These are a larger form *monticola*, and a smaller form, which both Messrs. H. and W. H. Edwards call *zerene*, Bdv. These both vary extremely on the under side, but in *monticola*, the males occasionally, and the females usually, have more or less silvery spots; whilst in *zerene* the duller and paler color of the under side is without any silver except on the marginal row. These distinctions, however, are based upon Californian specimens, mostly from the Shasta district, and, according to Edwards's opinion in 1879 (see *Can. Ent.* p. 55-56), do not apply to Nevada specimens. He then considered *monticola* to be only a var. of *zerene*, but put them down as two species in his catalogue of 1884. Further north, in the damper climate of Oregon and Washington Territory, as also commonly in Vancouver's Island, a darker form, *bremneri*, occurs, which on the under side is well spotted with silver in both sexes, and might be considered as the Pacific coast form of *atlantis*, but in the specimens taken on Mount Hood by Morrison (*rhodope* Edw.), and also occasionally in Vancouver, the silver is absent, and these specimens might well be considered as a northern and darker form of *zerene*.

*A. hippolyta*, which is also kept up by its author as a species, is described without reference to its allies, and seems to be something intermediate between *hesperis* and some form of *zerene* or *monticola*. Its locality would indicate that it may be nearer to them than to *atlantis*. It was described from four males and one female only.*

*Mr. Strecker informs me that *hippolyta* was de-

*A. adiante* is a form which both Strecker and Edwards consider distinct, and which appears to be very local. On the coast of California, according to Strecker's information, it is now extinct, and all the male specimens (I have seen no females) in Mr. Godman's and my collection were evidently taken many years ago. But, though the markings on the under side are nearly obsolete in some cases, and in all faint compared with those of *zerene* or *monticola*, yet they seem to be quite identical, and I should certainly be inclined to set it down as a variety of one of those species. This is just a case in which one would be guided by the opinion of local collectors, but neither Mr. H. Edwards or any one else of late years seems to have mentioned this species, and the opinions held twenty-five years ago, when Dr. Behr was an active collector, are not conclusive.

The intricacy and confusion of nomenclature among the next group of Argynnides, which inhabit the Rocky Mountains and Pacific States, is as great as among the last, but I have in this case followed Edwards's identifications of Behr's and Boisduval's species, which are supported by the named specimens sent me by Mr. H. Edwards, rather than the arrangement of Strecker's Catalogue, which makes *montivaga* and *egleis* varieties of *zerene*, Bdv. I cannot, however, follow Edwards in separating *clio* and *artonis* from *eurynome*, and Geddes, who took them in the Northern Rocky Mouutains, agrees with me in considering them as synonyms. As to *opis* and *bischoffi*, I am more doubtful, having seen but few specimens; but in these, as well as in Edwards's figures I can see no specific characters, and should consider them as northern varieties, differing only, as might be expected, in rather smaller size and duller coloration. Whether *montivaga* and its var. *egleis* are really distinct from *eurynome* and its varieties is hard to say; they seem to have the fore wings rather longer and the underside less tinged with green: they may, perhaps, best be treated as the west coast representative of *eurynome*. Edwards says of *egleis* (*Can. ent.* v. 2, p. 54) that whatever the variation in other respects (and he allows it to be very variable), the spots of the second and third rows on the under side of hind wings are heavily edged with black on the basal side. But I have specimens of *montivaga*, collected by Morrison in Nevada (of which sixty were also examined by Edwards), and others from the Sierra Nevada, California, named *montivaga* by H. Edwards and Strecker, which have the same character, and in some specimens of *eurynome* taken by myself in Yellowstone Park, the same black edging is more or less perfect.

I have also specimens of *arge*, Streck. from Strecker and Mr. Holland, both from Spokane Falls and California which are undoubtedly the same as *erinna*, which was described in 1883 as a var. of *eurynome* by Edwards, and in his Cata-

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scribed from some small examples of *bremneri*, given by Mr. O. B. Johnson of Oregon, to Mr. Dodge, of Nebraska, who gave them to Mr. W. H. Edwards. Some of the same catch and lot were also given to Mr. Strecker.

logue of 1884 is put down as a variety of *montivaga*. If, therefore, he is himself so uncertain of the true position of these forms, he cannot expect others to follow him blindly, and though many years must elapse before any certain conclusion will be come to, I venture to think that the arrangement I have adopted represents the facts shown by my collection, including about fifty specimens from all the States where the species occurs and from many of the collections which supplied his own materials. If it should eventually prove that the Pacific coast form is not separable from the Rocky Mountain form *montivaga*, it may be better to use the name *eurynome* in preference to *montivaga* or *egleis*, because both Behr's and Boisduval's descriptions which have priority over Edwards's, can only be identified with doubt. My specimens of *montivaga* and *egleis*, all come from the Sierra Nevada, and not from the Mt. Shasta district, where *monticola* and its vars. are so abundant; but local information as to their distribution, in this, as in the other cases, is very deficient.

INSECTS OF BERMUDA. — The Bermuda Islands by Professor Angelo Heilprin contains chapters on the insects, arachnida and myriopods of the Bermudas by Drs. P. R. Uhler, George Marx and the late Mr. C. H. Bollman. Dr. Uhler considers the species already found as almost entirely Nearctic in character but anticipates the discovery of multitudes of Neotropical forms. He does not enumerate the hymenoptera, lepidoptera, and coleoptera and his lists of the hemiptera, homoptera, pseudoneuroptera, dermaptera and diptera include but fifteen species or less than half the number recorded in Mr. J. Matthew Jones's "Visitors Guide to Bermuda." Dr. Marx mentions seventeen species of spiders, describing *Lycosa atlantica* as new. Mr. Bollman notes *Julus moreleti*. *Spirobolus heilprini* n. sp., *Mecistocephalus guildingii*, *Scolopendra subspinipes* and *Lithobius lapidicola* as all the myriopods that have been reported from the Bermuda Islands.

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DESCRIPTION OF THE LARVA OF MEGALODACNE FASCIATA. FABR. — COLOR. Body sordid white, with the patches on the segments above piceous; head light brown, mandibles piceous.

HEAD subglobose, small, smooth, shining.

CYPLEUS transverse, about five times as broad as long.

LABRUM somewhat narrower than the clypeus and about twice as long, anterior margin straight with a series of strong hairs; angles rounded; sides slightly oblique.

MANDIBLES short and thick with the apex strongly bifid.

ANTENNAE very short; two jointed; first joint short, and about three times as broad as long; second joint more slender and about twice as long as broad with the apex somewhat rounded.

MAXILLAE elongate, rounded at the apex with hairs and a few bristle-like short tubercles.

MAXILLARY PALPI three jointed; first joint much broader than long; second joint, less wide: third joint more slender and longer.

LABIUM subcordate, apex rounded; base much broader.

LABIAL PALPI two jointed; first joint, short, thick, twice as broad as long; second joint more slender, broader at the base than apex and about twice as long as broad.

BODY elongate, segments all about equal width and length except the first which is

narrower: last segment also narrower and bluntly rounded at the posterior extremity with two very short, pointed tubercles. On each segment is a transversely oblong, rugose, corneous patch divided in the middle by a narrow dorsal line.

LENGTH about 14 mm. WIDTH about 4 mm. Lives in numbers in fungus found on stumps and decaying trees.

*William Beutenmüller.*

OBSERVATIONS ON SATURNIA IO. — At Lexington, Mass, 3 July, 1888 I found on the upper side of a leaf of false indigo (*Baptisia tinctoria*) a cluster of about fifty (50) eggs. *Shape:* oblong, compressed on two sides. Attached to the leaf by their ends and touching each other by their sides. Arranged for most part in rows. *Color:* white, with black spots on outer end. In some the compressed sides were white, while in others they were partially yellow and in others still there was a black spot on each side. On 4 July I found on the under side of wild cherry (*Prunus serotina*) leaf a cluster of about thirty-four (34) eggs and these had hatched 6 July. The young larvae were brown, with the head much darker than the body. There were four rows of spines, sending out star-shaped clusters of concentric branches.

As observed by all writers who have described these caterpillars, they have an odd way of following each other, like a file of soldiers, keeping their line of march unbroken, even when turning corners.

The first moult occured 13 July, the second 22 July. I have no record of subsequent moults.

On the 20 July I found another cluster of thirty (30) eggs also on the under side of a wild cherry leaf. These hatched 2 August.

Again, 25 July, in the same situation I obtained a cluster of twenty-three (23) eggs. These hatched 1 August.

From these various broods of larvae I raised a large number of imagines, which afforded me a good opportunity of studying the typical and the variational forms. The following are my conclusions: the males differ from one another far less than do the females. In the latter the typical form has the fore wing plum-colored and the central dark spot of the hind wings nearly equidistant from the surrounding dark circle. From the plum-colored form there are several gradations of shade, till we reach a variety in which the fore wings are light brownish grey, with but little of the typical plum color. From the nearly equidistant spot of the hind wings we pass through gradations in which the spot has lost much of its roundness and become nearly contiguous with the circle, on the side towards the outer angle of the wing, till we reach a well marked variety in which the spot is pear-shaped with the small end turned towards the base of the wing, the large end almost touching the outer circle.

While the males present less difference, one from another, there is yet a well marked variety corresponding to that of the female just described. On comparison I find that out of more than thirty (30) females there are only four(4) with the pear shaped spot, while of twenty (20) males there are six(6) with this peculiarity.

Through the kindness of Dr. H. A. Hagen I have examined the specimens of *S. io* in the collection of the Museum of comparative zoology, where I find a very remarkable variety in a male, captured, I believe, by Dr. R. Thaxter at Newtonville, Mass., 27 June, 1870.

In this specimen the anterior wings were in the main typical; but the plum-colored concentric spots were somewhat peculiar, the outer ones becoming parallel lines instead of spots. It was in the hind wings that the aberration was most striking. The violet centre of the dark spot was reduced in size, and the surrounding dark area extended to the circle with only a mere suggestion here and there of the normal yellow belt between the dark spot and the circle. The latter, in its turn, had run over into the yellow belt beyond thus making a highly suffused variety.

It is my desire at some future time to ascertain whether these imaginal variations correspond with any larval peculiarities, and also whether they can be reproduced in breeding.

*Holmes Hinkley.*

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 167-168.**

MARCH–APRIL, 1890.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

[Entered as second class mail matter.]

PSYCHE.

# THE CORN DELPHACID, DELPHAX MAIDIS.

BY WILLIAM HARRIS ASHMEAD, JACKSONVILLE, FLA.

As is well known, the rapid changes taking place in the environments of a new country, under the influence of settlement and modern civilization, by the destruction of the forests and the cultivation of the soil, induce corresponding changes in the natural environment of insect life.

The natural food plants of hosts of insects are destroyed, and these are compelled, by the changed conditions, to seek among the plants brought by civilization such food as will sustain existence and perpetuate their species. Under these civilizing transformations, therefore, new insect pests are continually being brought to notice, appearing on some well known crop previously entirely exempt from their attacks, do great injury, cause the planter anxiety, attract the attention of the entomologist, and require skill and prompt measures for their destruction and the saving of a crop.

A new insect pest has lately appeared on corn in Florida, to which I have given the above name, that peculiarly illustrates this point.

It belongs to the family *fulgoridae*, subfamily *delphacinae*, in the order hemiptera, or suctorial bugs, and is apparently unknown to science, although found in great numbers on growing corn in my garden, and on coarse grass elsewhere. Up to the present time, no species in this family, at least to my knowledge, has as yet been described or reported as living on or injuring this cereal in either the United States or Canada.

Many years ago, however, Prof. Westwood, in the annals and magazine of natural history, v. 6. p. 413, published in London, England, in 1841, illustrated and described a species, very closely related to and resembling it somewhat, as seriously destructive to sugar cane in the West Indies; so that, after all, it is not so astonishing that a species in this family should now be found in the United States on so closely allied a food plant.

The "Corn Delphacid" was detected early in July, 1888, my attention being first called to it by the number of ants, *Cremastogaster lineolaris* Say, which were swarming on the leaves and crawling up and down the stalk. Ants never congregate in numbers without cause; and, an examination as to their superabundance at this time soon revealed itself in the discovery of this new corn

pest; for, as is the case when attracted to the aphides, occurring on other plants, they had gone there for the purpose of lapping up the saccharine substance, which, from the punctures of these pests, was exuding in considerable quantity, as a sweet viscid fluid, frequently covering most of the upper surface of the blades, and particularly in notches formed at the basis of the leaf-stalks, where the larvae and maturing insects were found to be fond of congregating.

INJURIES AND LIFE HISTORY.

The injurious affect, of this insect, on growing corn is readily apparent: the depletion of its juices and the saccharine substance on which the young and old feed, so necessary to growth and the maturing of the crop, occurs from the punctures of their beaks, whereby it is stunted in growth and the ears never fully mature; moreover, it is still further injured, scarred and disfigured by the ovipositor or egg-borer of the female, which is used as a saw or borer, to cut into the cellular tissue of the blade or stalk, where she deposits her eggs.

The little cicatrices or scars, thus made, and the depletion of the juices of the plant from the punctures of their beaks, give to it a diseased, sickly appearance, that, in connection with the swarming ants and flies, cannot fail to attract attention.

No delphacid, that I am aware of, has ever been thoroughly worked up in all its stages, and the egg and newly hatched young have never been described or figured; and, as these are peculiarly characteristic and probably of biologic importance, it is particularly gratifying to me, to have been so situated to work up the life history of the present species, and, to be able to present illustrations of their many remarkable peculiarities.

Finding the species so plentiful on corn and grass in my own garden, for some weeks, it was possible to make visits daily, and thus, the opportunity and satisfaction in working up and studying the insect in all its stages —to a naturalist, the greatest of pleasures — was afforded me.

The egg, (fig. a), about 1 mm. in length, is of a greatly elongated shape, narrowed into a more or less distinct neck at base, and of a translucent white color, except a yellow yelk-like spot near the base, shown in the figure as a black dot.

The female makes an incision, with the ovipositor, under the epidermis of a leaf or in the stalk, into the cellular tissue, of a sufficient size to contain two eggs together, as is shown in the figure. After oviposition, the orifice is cemented with a greyish or white glutinous substance that appears externally, on the surface of the leaf or stalk, only as a cicatrice.

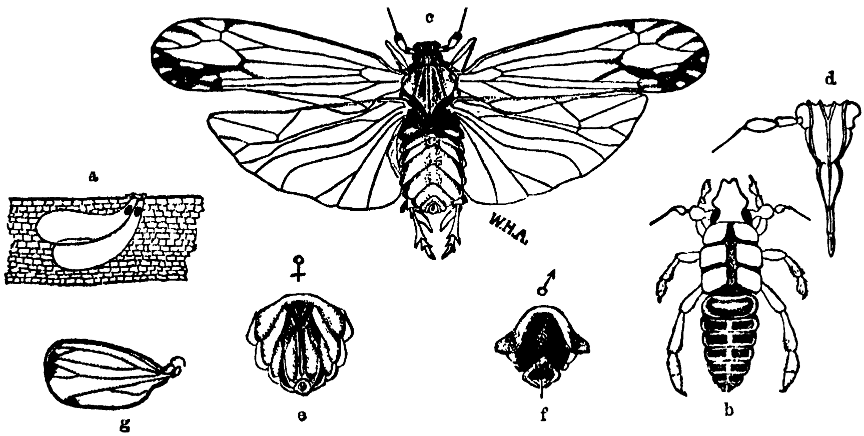
The eggs are laid in regular rows, a slight distance apart, and invariably two are found together, never more or less. Hundreds were examined but I always found two together, as illustrated.

The egg hatches in from a week to ten days, and a succession of broods

appear all during the last of July, August and September, the young and old, in various stages of growth, appearing together. Whether the broods appear later than September I cannot at present tell, as my observations on the species were abruptly terminated by the yellow-fever epidemic.

The newly hatched larva is shown in figure *b*. It is of a pale greenish white color and less than 2 mm. in length, and insect assuming more and more the appearance of the imago; the cephalic prolongation disappears with the third molt, when the frontal carinae are more or less distinctly visible, as well as the three carinae on the thorax, and distinct wing pads appear.

There are two distinct forms of imagos—a perfect winged and a brachypterous form—which are briefly described below, being, it is believed, together




in some of its characters quite dissimilar to the adult: The head has a remarkable cephalic prolongation, shaped as in the figure; the thorax exhibits dorsally six quadrilateral plates; the abdomen is composed of 7 segments, the basal one being the longest; the middle and anterior tarsi are only 1-jointed, while the posterior tarsi are 2-jointed, the posterior tibiae being without the large movable spur, so characteristic of the adult.

From this stage to the adult there are five distinct molts, after each molt the with the figure, sufficient to distinguish the species.

*Delphax maidis n. sp.*

♂ Length 2 mm.; wing expanse $6\frac{3}{8}$ mm. Pale greenish-yellow, in death pale brownish yellow; apex of 1st and the apical half of 2nd antennal joints, lower part of frons, spots on pleurae, most of the abdomen, except the 1st ventral segment and the lateral edges of the dorsal segments, smoky black.

Legs pale, the femora more or less embrowned; apex of posterior tibiae with

several black tipped spines and a large movable spur; tarsi 3-jointed, the basal joint longer than the other two together, all with black tipped spines or teeth at apex; the anterior and middle tarsi shorter, the terminal joint the longest, longer than the first two together. Face with three keels, the middle one forked on the frons above; clypeus also tricarinated, the middle carina delicate; beak, apparently, but two-jointed, reaching far beyond the middle coxae, the first joint being slightly the longer. Prothorax and mesothorax tricarinate, those of the last being delicate or subobsolete. Front wings pale greenish-brown, sub-hyaline, the apex of the clavus and veins of apical cells more or less distinctly surrounded by fuliginous clouds, as shown in the figure (c).

♀. Length $2\frac{7}{8}$ mm.; wing expanse 7 mm. This sex agrees with the male, except its slightly larger size, the clypeus as well as the frons and all the coxae are more or less distinctly embrowned or blackish, while the apical edges of the abdominal segments, as well as the lateral edges and a broad dorsal stripe, are yellow.

The ventral apical aspect of the two sexes is shown in figures *e* and *f*; the head and antennae in figure *d*.

The brachypterous form measures 3 mm. in length, the abdomen being much broader and more depressed than in the fully winged form.

The aborted wings, shown in figure *g*, are less than 3 mm. in length, with a spot at apex of clavus and two on the apical margin, the venation as in the drawing.

PARASITES.

The species is subject to the attacks of a dipterous parasite and probably also to hymenopterous parasites belonging to the subfamily *dryininae*. A single ♀, unfortunately killed in the cyanide bottle before I discovered the fact or I might have reared it, exhibited peculiar inflated or oval projections issuing from each abdominal spiracle, covered with a dark colored, felt-like skin, which, on dissecting under the microscope, I found each to be the recepticle of a puparium of a dipteron closely allied to, if not, a *Cecidomyia*.

Another year's observations will probably enable me to rear this parasite and settle definitely to what family it belongs and it is only mentioned at this time as an interesting fact in its life history well worthy of record.

# THE PARTIAL LIFE-HISTORY OF PSEUDOHAZIS EGLANTERINA, WITH REMARKS ON THE LARVAE OF ALLIED GENERA.

BY ALPHEUS SPRING PACKARD, PROVIDENCE, R. I.

I am indebted to Prof. C. V. Riley for the opportunity of examining the larvae in alcohol of the first stage of this species, which were collected at Manitou, Col. I have carefully compared these with freshly hatched larvae of *Hyperchiria io*. When first hatched the form of the head and shape of the body are as in *H. io*, but the larva is somewhat larger. The generic differences from *H. io* are confined, not to the number and arrangement of the spiniferous warts, but to the shape of the spines themselves, and this makes it evident that in probably all the genera and species of the *hemileucini* of Grote, the spines themselves are especially developed at first with reference to the protection of the young larvae, which huddle together in masses so that their bodies are protected from observation. Later in life the spines are smaller in proportion to the body because more scattered, and then it is that the larvae are protected by the poisonous nature of the spines, the body itself being more uncovered and conspicuous. It is just the reverse of what takes place in the arctians and other larvae which become very hairy or bristly late in larval life, and are sparsely provided with hairs when first hatched. It will also be seen that in respect to the spines the present species when first hatched is much more highly specialized than *H. io*, the latter being more simple and generalized a form as regards the spiniferous warts.

*Stage 1.*—Length 5 mm. The spiniferous tubercles are arranged, as in *H. io* in eight rows, those of the two rows, one on each side of the median line of the body, and the subdorsal ones being the larger and longer, while those on the side of the body become shorter and smaller as they approach the under side of the body. The spine-bearing warts are larger and swollen compared with those of *H. io*. The dorsal spines on the prothoracic segment* differ from those of *H. io* in having the trunk spinulated, the spinules being long and each bearing a long, tapering hair; the main spine is pale but ends in two long black forks, each tine of which is 2-3 as long as the trunk of the spine itself, while the bristle arising from each fork is as long as the latter. The spines of the two lower rows are spinulate on the trunk but are pale throughout, while the larger ones on the back are dark at the end, being pale at the base. The dorsal spines on the abdominal segments

* In describing caterpillars it is well, especially in those of bombyces, to distinguish the three first segments behind the head as the thoracic; the ten succeeding ones as the abdominal segments.

differ from those of the thoracic segments in having a somewhat verticillate arrangement of the large five or six terminal spinules, all being pale except the terminal one, which is considerably larger than the others.

The single median spines on the 8th and 9th abdominal segments respectively, occupy the same position as in *H. io*, but are larger in proportion and are *not forked* as they are in *H. io;* on the contrary they resemble spines, one being larger and darker than the others; the spine on the 9th segment is a little smaller than the one preceding it.

To recapitulate, it will be seen that the spinulate spines of *Pseudohazis eglanterina* in stage 1 are more complicated than those of *Hyperchiria io* of the same stage, so that the body is more concealed from view. The thoracic dorsal spines are forked but not so simply as in *H. io*, while the median single ones on the 8th and 9th abdominal segments are not forked but more or less densely spined in irregular whorls, with one of the spines larger than the others.

*Fully grown larva.*—The following description was drawn up many years ago from between forty or fifty alcoholic specimens from the Gulf of Georgia, Cal., in the Museum of comparative zoology. There was no noticeable variation in the lot. The larva is intermediate in its characters and in size between *Hemileuca maia*, which it more nearly approaches, and *Hyperchiria io.* The head is smaller than in either of the two genera mentioned; in the thickness of the body it approaches *H. io* rather than *H. maia.* The shape of the clypeus is much like that of *H. maia.* The dorsal spines are whorled as in *H. maia.* The lateral subdivided or whorled setiferous spines are longer than those of the two dorsal rows, but are not so long as in *H. maia.* The arrangement of the longer spines on the thoracic segments, and on the 8th and 9th abdominal segments are as in *H. maia*, but they are shorter, more bushy and more subdivided. The suranal plate is triangular lunate. The dorsal spines are shorter and sharper than those of *H. maia*, being very sharp and the prick painful even in alcoholic specimens.

The head, body and spines are black; in *H. maia* the head is reddish, in *H. io* amber. There is no special coloration to mark the larva of *H. eglanterina*, the body in alcoholic specimens being uniformly dark.

*Larva of 4th stage.* —The larva in this stage scarcely differs from that in the last stage, the inequality between the length of the dorsal and upper lateral spines is observed in this stage.

Mr. H. Edwards has described (Proc. Cal. acad. sci., 19 April, 1875), the eggs and the mature larva; he states that it feeds on *Frangula californica* and *Rosa.* He states that the head is black, and the body entirely dull black. "Each segment is armed with six lateral spines, very finely branched, and two dorsal fascicles of spines, bright chestnut

color, blackish in the centre. The branchlets of the spines are all bright chestnut in color. Underside as well as the feet and abdominal legs dull black. Length, 2.00 inches."

It is interesting to compare the generic forms. It is usually impossible to draw up comparative descriptions of caterpillars while living, from the obvious fact that one may only have a single species under observation, alive at one time, and for this reason a collection of carefully preserved alcoholic, as well as of blown specimens is all important; and I may add that for the careful study of structural features I much prefer good alcoholic specimens to blown ones, if the caterpillar has been at first killed in very weak alcohol, and, say, a couple of days later transferred to strong alcohol, so that the body does not become too much contracted, and the coloration faded.

I will now add a description of some alcoholic specimens of *Hemileuca maia* contained in the Museum at Cambridge, drawn up as long ago as 1862 or 1863. They occurred in New Jersey in July and were compared with *Pseudohazis eglanterina*.

It is larger, the head larger and dark mahogany in color. There is the same arrangement of spines, but in *H. maia* they are throughout longer than in *P. eglanterina;* they are much stouter, and are paler at the ends. The surface of the body is marbled with pale flat tubercles. The underside of the body is naked, where in *P. eglanterina* it is somewhat hairy.

At another time I compared mature *H. maia* from Georgia with *H. io*, with the following results. The head in the two genera is of the same size, but in *H. maia* it narrows towards the vertex. The clypeus of the latter genus is a little larger, and the sides bulge out rather than curve in as in *H. io*, and the surface is more sunken. The body is rather more elongated and slenderer than in *H. io*. There is a median dorsal line, and two subdorsal broad bands, dotted with light oval spots in *H. maia*. The suranal plate is elongated lunate, approaching a triangular shape. The sides of the anal lip are thickened throughout, more so than in *H. io*.

*Note.*—The author would take this opportunity to say that he is collecting materials for a monograph of all the Bombyces with especial reference to complete life histories, to be illustrated by colored plates. He is especially anxious to obtain the eggs of any species of *Gastropacha* as well as the mature larva, also those of any species of *Hemileuca*, *Pseudohazis* and *Hyperchiria* except those above mentioned, and also desires the eggs and larvae of the species of *Euleucophaeus*, *Coloradia* and *Quadrina*.

# THE ARGYNNIDES OF NORTH AMERICA.

BY J. J. RIVERS, BERKELEY, CALIFORNIA.

In the February numero of PSYCHE appeared a reprint from the Transactions of the entomological society of London, upon the North American Argynnides by Henry John Elwes. Those who have had the pleasure of studying Mr. Elwes's treatment of the genus *Parnassius* (Proc. zool. soc. Lond. 1886), must have a high and respectful opinion of any other matter upon which he undertakes to write. Mr. Elwes calls this later paper a "Revision" but, it appears to me more like a timely consideration preparatory to a revision. The difficulties in the way of a revision, allow me to say, have not yet been surmounted; the absence of knowledge of the metamorphoses of so many forms prevents a proper understanding of a true relation of one form to the other. The comparative work of the cabinets is frequently of no value through the meagre material and unauthenticated types, observers have to deal with, causing different conclusions even among associates equally able to judge. We must remember, too, that the observers are but ordinary mortals and that nature has thought it a fit and proper thing to place upon the workers in this Western world, a problem that will exhaust the love and energy of the next two generations of lepidopterists, to solve. The insects often differ but slightly from each other, and the variation is frequently not so much in the insects as in the eyes of the investigators. There are some persons who can scarcely see any variation in forms which to another person appears entirely unlike. In the absence of biologic information how are we to be certain of the extent of variation of a species unless each is bred under careful observation?

This is the method now being carried out principally by Mr. W. H. Edwards, the final results being given in accurately drawn figures of all the conditions and changes appertaining to the natural history of each species. It was getting at the life history of *Colias eurytheme*, that furnished the facts that revealed its relation to its seasonal varieties, which before this, had borne specific names; and it appears to me that a like course is the only safe one, if we would know with what we are dealing. Every person who describes an insect supposes that without doubt he is giving the characters of an undescribed new form, and no author ever dreams that his work is only provisional, yet with additional knowledge upon the subject, that is what it frequently proves to be. There is, however, no prevention of this and when the true information is reached these false species simply drop into synonymical line.

Most of us think that we can pen a readable description of an insect, forgetting that the proportion of persons so capable, is very small. Dr. Behr, H. Edwards, W. H. Edwards and H. Strecker besides Boisduval have all dealt with the Pacific forms. Part of their work represents first impresions only, while some of it partakes of the form of digested considerations. Now comes Mr. Elwes who has redigested the investigations of those who have preceded him the conclusions being a general merging of forms and great reduction of species, and all that can be said in favor of this newer treatment is, that it possibly tends in the right direction. Mr. Elwes remarked that he found species difficult to decide about, but that Mr. Edwards got over the difficulty by naming them all separately. What else could he do in an empirical provisional arrangement but to make his skeleton and clothe it as he could obtain the materials wherewith to make it perfect? No! Edwards has got over no difficulties in that way, but he surmounts them by zeal mixed with a deal of honest hard work. Mr. Elwes is inclined to consider *A. adiante* a variety of either *zerene* or *monticola* I on the contrary feel constrained to look upon it as having little relation with either of those forms. Neither *zerene* nor *monticola* have yet been seen in the habitat of *adiante* so that as far as we know, *adiante* is strictly a local form, species or variety, though if they were to occur in company that would prove no unity of species; I take *zerene*, *liliana* and *rupestris* in company (this *rupestris* being *montivaga* Behr), the locality being of a similar nature, in Napa Co. to that which produces *adiante* in San Mateo Co. But Mr. Elwes thinks there is no affirmity between *adiante* and *semiramis*. When speaking to Dr. Behr about *semiramis* he remarked that in all probability it was a southern form of *adiante*. This is a case showing the uncertainty of eye sight. I look upon them as true and distinct and, moreover, I see nothing but the silver to connect *semiramis* with *coronis* but on the contrary I see much in it that reminds me of another and altogether different type. Take examples of the Arizonian *nokomis* male and of *aphrodite* male, of *semiramis* male and of *adiante* male and female, and examine them from above and you will perceive they all possess the same tone of yellow brown and that the hind wings of all have the same style of interrupted bands of black; the peculiar yellowish brown that softly fades toward the hinder part of the hind wings, is unlike any tint seen on any other butterfly found in California except *adiante* and *semiramis*. I shall, for the present at least, keep *adiante* free from all alliances, and the other species, though the richly emblazoned underside of the hind wings is a point of some weight, yet in the midst of so much uncertainty it were better to still inscribe on its label as usual, *Argynnis semiramis*, W. H. E. than the other which was suggested in Mr. Elwes's paper.

# DIARY OF A HIBERNATING BUTTERFLY.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

Doubtless in acknowledgment of the honor just conferred upon it by giving it a new and euphonious name in my "Butterflies of the Eastern United States," a fine specimen of *Euvanessa antiopa* came to pass the winter with me, taking up its station in the cellar directly beneath the room where the Cambridge Entomological Club holds its meetings. It was first noticed about the middle of November, before the cellar windows had been closed for the winter. It was then pitched on the top of the cellar-wall where this was exposed in the passage-way down stairs. For fear of its falling a prey to the mice which had been seen here, it was driven away, when it at once took up its station about eight inches above the cellar floor on the "riser" of the first stair, just beneath the projecting edge of the first "tread," the extremity of its wing projecting beyond the tread. Here it remained all winter, until the last days of February, not, however, without moving; the position of the wings was marked with a pencil on the edge of the tread, and it was found to have shifted its position repeatedly — some six or eight times — sometimes forward, sometimes backward, within a range of about an inch; about the middle of January its position changed from perfectly horizontal to slightly oblique, the head downward, and on the very morning of the day it left the station it was noticed to have shifted a very little more, increasing its obliquity. During all this time the wings were kept in an identical position, back to back, the fore wing thrust forward just so much as to bring the tooth at the tip of the lower median nervule of the fore wing exactly midway between the subcostal tooth of the same wing and the tooth of the upper median nervule of the hind wing. This is exactly the position of complete repose in summer. The station chosen was a curious one, being *directly* beneath the spot where the right foot, always first advanced, was placed upon the first tread, and a movement of air must at least have been perceptible to it whenever one went upstairs or down, but in only a single instance was any apparent agitation produced; this was when the cellar doors ten feet away from it were opened, on a tolerably cool day, and for three hours men were passing back and forth bringing in wood; then a slight vibration of the wing-tips was seen, but no sound could be detected.

In a wintering *Polygonia* observed by Goossens in Paris, the fore wings responded to the warmth of the weather by creeping forward and backward between the hind wings a very little, with-

out any other noticeable movement. This I was unable to detect in *E. antiopa*, perhaps because the cellar temperature would not vary nearly so much as the outer air, especially as it contained a furnace at about twenty-five feet distance; but particular attention was paid on the coldest and warmest days without detecting any difference of position of the wings. What the cause of the slight forward and backward movements might be was not discovered; it seemed to have no relation to the weather or to the amount of light. It may be added that until the position became oblique the wings were held horizontally with a scarcely perceptible tip upward toward the "tread," the legs on the upper side being bent slightly more than those on the lower side; but when the oblique shift was made, the tip was very slightly increased, to about ten degrees in all.

It finally flew to a small window about six feet above its hibernating post, where it was found at about 2 P. M. on 28 February, having left its winter quarters since 1 P M. It was in a curious position: it had evidently alighted on the vertical surface of the lower sash, head upward, and had lost its hold, the smoother surface not permitting its claws to hold so well as in its hibernating station, and had fallen backward upon the top of the ledge an inch or two beneath, and there remained upside down, balanced on the top of its erect wings, the margins of the hind pair spreading by the weight and so preventing it from tipping over; in this strange position, feet upward, where a mere breath of air would have thrown it over, but from which it could free itself only by flapping its wings, it remained for more than an hour, but by about 3 P. M. was found to have righted itself and pitched with erect wings, head downward, on the cellar wall a few inches away.

February 28 was a cloudy, cool day with rain, the thermometer at the time of its flight about 42°. In the cellar it was about 48°–50°. The only time that the outer air had free access since the closing of the windows late in November was when the wood was brought in early in February.

The butterfly remained in the position it had taken on the afternoon of 28 February until about noon of 5 March. During the warmer days when the rays of the sun fell directly on the apical half of the wings, it would thrust its antennae forward at an angle of about 45° with each other and at an angle with the costal edge of the fore wings of about 35°; at other times the antennae were kept between the fore wings out of sight, just behind the costal margin, as I found out by parting the wing-tips carefully without in the least disturbing it. It shifted its position slightly from day to day much as it had done on the stair, but retained practically the same foothold with which it had alighted. I had to pass the place more than a dozen times a day, my shoulder within a foot of the butterfly, but the only effect

shown was when the antennae were extended as if alert. Then my presence near at hand or my passing would be recognized by a rocking or bowing motion of all the wings in common, produced, apparently, by the action of the middle legs in lowering and raising the body upon the pivot formed by the insertion of the hind legs; the tips of the wings moved slowly forward and backward, the forward motion more abrupt than the backward, over an arc of not more than a quarter of a centimetre; the motion was accompanied by no perceptible sound.

On the 5th, a bright, warm day, the butterfly had turned back to the window at about noon, and my appearance led to some fluttering against the pane. As I remained motionless, it gained heart, walked about the broad ledge beneath the window with open wings and antennae spread at right angles, with every few steps depressing them like stiff sticks till they touched the ground, beating time, as it were, with its march, and, finally, took up its position on the ledge, and turning its back to the sun, expanded its wings fully, even depressing them so that the tips touched the surface of rest; the antennae retained the alert position of the day before. Wishing to see what would happen I moved from my position directly opposite the window, my head about three feet away, toward the butterfly, but as slowly as possible. No effect was produced until my eyes were within a foot of the butterfly facing me, when its wings shut with a snap and then began to vibrate; the tips of the wings appeared to have a lateral vibration of not more, probably considerably less, than a couple of millimetres, while the antennae vibrated forward and backward as much as laterally, and not over a millimetre. I could perceive no sound whatever. I slowly turned my head to bring my ear opposite, but could still detect nothing. On endeavoring to bring my ear still nearer by the quietest possible approach, the butterfly flew again to the window and fluttered about. Subsequently, I got within six inches and could then distinctly hear a rustle like the flapping of the wings of an insect against a window pane at a distance, and could see that there was not the slightest motion of the fore wing on the hind. It afterwards partook so greedily of some half-rotten apple offered it that it permitted me to hustle it about with my finger without apparent fright.

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New Trap-door Nests of Spiders.—In two recent papers, Arachnides du Venezuela, (Ann. soc. ent. de France, 1889, v. 9) and Avicularidae du Nord de l'Afrique, (Actes soc. Linnéenne de Bordeaux) E. Simon describes and figures a number of new nests of *mygalidae*. Among the Venezuela species, *Pseudidiops opifex* makes a short tube with trap-door on branches of trees. The tube is attached to the bark by one side and covered with bits of bark and lichens. *Stothis astuta* makes a short tube with a trap-door at each end. sometimes the tube is among loose rubbish on the surface of the ground and is then straight. In other places where the soil is more solid it burrows obliquely below the surface, carries the tube a short distance just under ground and turns it up again to the surface. *Rhytidicolus structor* makes a nest of three distinct chambers connected by narrow openings both closed by trap-doors, the one between the first and second chambers opening inwards. The cocoon is flat and is hung across the outer chamber. *Psalistops melanopygia* makes a tubular burrow, lined partly with silk, and with a branch near the upper end like many other species, but with no trap-door, and conceals the mouth of the tube with leaves and rubbish. *Epipedesis opifex* makes a simple furrow on the surface of the ground under a stone or moss and covers it with silk.

Among the African species *Leptopelma cavicola* makes a branched tube without any trap-door. *Dolichoscaptus latastei* carries its tube with trap-door ten centimeters above the surface of the ground making it stiff with bits of dirt and leaves fastened with silk to the outside. *Dolichoscaptus vittatus* was found in several cases to bore at the bottom of its burrow a short tube too small for the spider, filled with the remains of insects that it had eaten. *Dolichoscaptus artifex* makes a very peculiar,complicated burrow. At the mouth it has the usual flat trap-door. A short distance below the surface the burrow is enlarged into a spherical cavity in which works a door of a different kind. It consists of a lump of dirt covered with silk, shaped like half an egg with the edges rounded off and large enough to half fill the spherical cavity. When turned with its longest diameter vertical and its convex side against the wall of the cavity it leaves room for the spider to pass on the opposite side from the upper to the lower part of the burrow. When turned with its longest diameter across the burrow it closes it completely. To complicate this arrangement still more, a flexible tube of silk, continuous with the lining of the lower part of the burrow and open at the top, is attached along the flat side of this door so that when the door is open the spider passes up or down through this tube, and when the door is closed the tube is flattened against the side of the burrow.

*J. H. Emerton.*

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Otiorhynchus sulcatus injurious to plants in greenhouses in Massachusetts.—Mr. W. M. Corving of West Roxbury wrote me 5 March, 1889, that the Cyclamens in the greenhouses of the Messrs. Fisher Brothers of Montvale, Mass., were seriously injured by a beetle. The injuries were confined chiefly to the flowers but sometimes the bulb was destroyed. The leaves being hard and leathery escape injury. Mr. Corving sent me a specimen which proved to be the well known European weevil *Otiorhynchus sulcatus*, the existence of which in Massachusetts has been known for a very long time. Dr. Horn gives as localities Massachusetts, Canada, Newfoundland and Nova Scotia; all of these are represented in the Leconte collection. The general collection of the Museum contains two specimens from Europe (Ziegler collection) and six specimens collected in Cambridge in 1872 by Boll. I was interested to know when and by whom the beetle was first recognized here. Schoenherr (Curc., 1843, v. 7, p. 371) gives *O. apiculatus* Say Mss. as a synonym of *O. sul-*

*catus.* Harris in his catalogue (second edition 1835) has first mentioned Say's species and in his manuscript catalogue records receiving the same from "Doct. Gould, another from Dr. Smith." This entry is inserted between specimens collected in May and June, 1831. Prof. Riley in his third Missouri report (1871 p. 11) states that the species infests the crown of strawberries but does not say where it was observed. Provancher speaks of the species as "très commune." Lintner in his second report (1885 p. 51) mentions it as injurious to bulbs and house-plants. I do not find the species recorded west of Pa. In the European literature it is mentioned everywhere and the early stages are described by Bouché, Westwood, Lucas and others. *H. A. Hagen.*

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NOTES ON COLIAS EURYTHEME AND C. PHILODICE.—In the vicinity of Charleston, S. C., where most of my observations have been made, *Colias eurytheme* is the characteristic type. I may say, in fact, that it is the only member of the genus that I have ever seen on the seaboard. It is as plentiful there as *C. philodice* usually is in its proper range, though not seen, as far as I know, in the countless hordes in which the latter is said to congregate at times. In Clarendon County, S. C., where I have collected, off and on, for a good many years, *C. eurytheme* was not as abundant as on the coast, *C. philodice* not found at all, and *C. caesonia* taken occasionally. In Ashville, N. C., where *C. philodice* is very abundant, I have never seen *C. eurytheme;* and *C. caesonia* but once. Spartanburg County, S. C., is the highest locality in which I have yet found *C. eurytheme.*

I have never seen *C. philodice* at all in South Carolina until this autumn; at which time I was enabled to do considerable collecting in Columbia, a locality where I had never collected before. Here I found *C. philodice* and *C. eurytheme* occurring in equal and considerable abundance, and this spring I meet *C. philodice* and *C. ariadne* in about the same proportion. I have noticed a decided difference of manner between the two; *C. eurytheme* being much swifter in flight, its stop at a flower less prolonged, and its whole manner more decided; and it is also much more wavy and therefore more difficult to catch than *C. philodice.* In this respect, my experience is, to use an equation, that *C. philodice : C. eurytheme :: C. eurytheme : C. caesonia.*

Our normal spring form of *eurytheme* is *C. ariadne.* I have taken, this past January (12th to 24th et seq.) a large series of *C. ariadne*, which are, on the average, identical with forms from Texas, and show no marked variation from a few that I have from Wisconsin. A pretty full series of western *C. eurytheme* in my collection, consisting of specimens from five states, from Wisconsin to California, present no marked difference from our autumn *eurytheme;* possibly in one or two cases, the western form may be a trifle more irridescent than our average; but I have one July ♂ taken in Charleston, that is fully as rich in color, as any that I possess from the west. I notice among these western forms some that appear to me to be unmistakably *C. keewaydin:* this form I have not taken here, though I have a few *C. ariadne* from Charleston that are very large and yellow and seem to intergrade with *C. keewaydin.*

The autumn ♂♂ of *C. philodice* taken in Columbia are much larger than northern forms of the same in my collection from Princeton, N. J. We have a spring form of *C. philodice*, bearing the same relation as far as size is concerned, to the autumn *C. philodice*, that *C. aridne* bears to *C. eurytheme.*

In the city of Charleston, I have taken the eggs of *C. eurytheme* from white clover, as they were laid by the female.

The white ♀♀ of both *C. eurytheme* and *philodice* I have taken here, in Columbia, in spring and autumn.

*C. caesonia*, the only other of the genus found with us, is by no means abundant, though not infrequent last autumn. I captured six in Columbia, in October and November, 1889. *Elison A. Smyth, Jr.*

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 169.**

MAY, 1890.

*CONTENTS:*



PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

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# PSYCHE.

## DESCRIPTIONS OF SOME NEW NORTH AMERICAN DOLICHOPODIDAE.

BY WILLIAM M. WHEELER, MILWAUKEE, WIS.

Since the publication in 1864 of Loew's admirable Monograph of the North American *Dolichopodidae*, very little work has been done on these interesting diptera. Baron v. Osten Sacken in his "Western diptera," published in 1877, described from California nine new species, belonging to the genera *Hygroceleuthus*, *Dolichopus*, *Tachytrechus*, *Liancalus*, *Scellus* and *Polymedon*. The last is a new and very peculiar genus. Mik, in 1878 (Verhand. d. zoolog. bot. gesell. p. 617-632) described one new North American species for which he erected the genus *Hypocharassus*. More recently, in 1888, Bigot (Bull. soc. ent. France XXIX, XXX) has described eight new species from Hayti, Mexico, North Carolina and California, representing several new genera.

Barring these contributions, our knowledge of the North American *Dolichopodidae* has made no advance since Loew's time. This is not to be attributed to inattention on the part of living dipterologists, but rather to the thoroughness of Loew's work. From a taxonomic standpoint little is left to the ἐπίγονοι besides the filling out of the unavoidable gaps in the work of the master entomologist.

Like other students of our diptera, who have given some attention to the *Dolichopodidae*, I can add very little to Loew's work. With three exceptions the species here described fall naturally into genera defined and adopted by Loew. For these three exceptions I have erected two new genera, *Peloropeodes* and *Aphantotimus*, based, I believe, on sufficiently distinctive characters. The former, including as yet only one species, *P. salax*, is allied to *Rhaphium;* the latter, to which I assign two species, *A. willistoni* and *A. fraterculus*, is allied to *Chrysotimus*. *Peloropeodes* is interesting as forming a link between those higher forms, which, like *Dolichopus*, have large disengaged hypopygia and the genera like *Rhaphium*, *Porphyrops* and its allies, which have the third antennal joint elongated, tapering, with apical arista, and the hypopygium small and more or less imbedded. *Aphantotimus* appears to

form a similar link between the *Dolichopus*-like forms and the species of the genus *Chrysotimus*.

DOLICHOPUS ALBICILIATUS, Loew. ♂.

Length 6 mm.; length of wing 4. 5 mm.

Face narrow, covered with silvery white dust. Antennae black, third joint small, rounded anteriorly. Front dark bluish green; cilia of the superior orbit black, those of the inferior orbit pale yellow. Thoracic dorsum shining dark metallic green; pleurae black, anteriorly, with greenish bronze reflection, posteriorly dusted with white. Tegulae with black cilia. Scutellum dark green with violet reflection. Abdomen dark bluish green, the terga of the first and second segments with violet reflection; incisures broadly black; venter black, powdered with white dust; hypopygium black, opaque, with pale dull yellow lamellae of subtriangular outline, apical margin rather evenly crenulate, broadly bordered with black and fringed with delicate long hairs; penis and other appendages pale yellow. Coxae opaque black, tipped with yellow; the anterior pairs with several curved black bristles on their fore faces; all the femora black, with metallic green reflection, broadly tipped with yellow; anterior tibiae pale yellow, with black setae, which are conspicuously long on the fore pair; anterior tarsi pale yellow, blackened from the tip of the first joint; hind femora ciliated with long and delicate hairs on their inner faces; hind tibiae slightly incrassated, pale yellow with their apical third black; hind tarsi black, the metatarsal joint slightly incrassated. Halteres dull yellow. Wings grayish hyaline; veins black; the juncture of the first logitudinal vein with the costa thickened, though not to the degree observed in the males of some allied species; last section of the fourth vein appearing considerably steeper than in the ♀ and meeting the costa nearer the end of the third vein.

HABITAT: Wisconsin.

Only the female of *D. albiciliatus* was known to Loew. In view of the fact that the male is from a taxonomic standpoint by far the more important sex in the study of the *Dolichopodidae*, I have in this as in the case of a few of the other species, of which the males were unknown to Loew, inserted a description.

DOLICHOPUS INCONGRUUS, n. sp. ♂.

Length 5 mm.; length of wing 4.75 mm.

Dark metallic green. Palpi black; face narrow, silvery white. Antennae large, entirely black, the two basal joints short and small; third joint unusually large, flattened, suboval, dorsal contour straight with the arista inserted near its middle, ventral contour evenly rounded. Pubescence of the eyes distinct, white. Cilia of both the superior and inferior orbits black. Front and thoracic dorsum deep metallic green, the latter with a cupreous reflection in the median line and on its humeral edges; pleurae black, dusted with white. Tegulae yellow with yellow cilia. Scutellum and abdomen deep metallic green varied with cupreous; venter black, covered with white dust; hypopygium large, swollen, black with metallic green reflection and white dust; penis and internal appendages yellow; lamellae small, elongate oval, tapering but rounded at their tips, edges black, scarcely jagged and fringed with short and weak black hairs. Coxae black, and like the pleurae, dusted with white; apical third of the anterior face of the fore coxae and tips of the posterior coxae yellow; the usual tufts of black hairs on the anterior faces of the fore and median pairs and a single backward directed seta on the lateral face of the hind coxa. Fore legs yellow; the basal two-thirds of the femora black; tarsi about as

long as the fore tibiae, plain, being neither attenuated nor infuscated. Median legs pale yellow throughout; femora with preapical bristle. Hind femur eciliate, black, with yellow tip and with preapical bristle; tibia setose, not incrassated, with its anterior face and tip black, its base and posterior face yellow the latter with five prominent setae; tarsi entirely black. Halteres yellow. Wings gray, hyaline; the venation resembling that of other dark-legged species of *Dolichopus*; costa presenting a short but distinct swelling at the juncture of the first longitudinal vein; this swelling does not interrupt the straight outer contour of the costa but bulges out distinctly on its inner edge; veins black posterior cross-vein forming right angles with the fifth longitudinal vein. The base of the wing is rather acute.

HABITAT: Milwaukee Co., Wis.

This species is to be admitted to the group comprising Loew's *D. pachycnemus* and *brevipennis*, both of which are characterized by having the cilia of the inferior orbit black, while the prevailing color of the legs is yellow. The male *incongruus* differs from the males of both of Loew's species in having the tegular cilia yellow, in the coloration of the legs, in having the fore tarsi plain and the hind femora eciliate. There are several other differences but these will suffice to separate the species.

DOLICHOPUS SCOPARIUS, Loew. ♂.

A male agreeing closely with Loew's description of this species was sent me from Mass. by Mr. S. Henshaw. The hypopygial lamellae were so nearly destroyed in the single specimen from which Loew's description was taken that he could only affirm that they were yellow. In my specimen they are well preserved and very unlike the hypopygial lamellae of other species of *Dolichopus* known to me. They are rather large, entirely pale yellow, of a rhomboidal shape, and have their somewhat swollen edges smooth and entire, not jagged as in other species. The upper (or when the hypopygium is flexed back in line with the abdomen, the under) edge is slightly twisted, folded in and fringed with delicate black hairs, which I take to be the homologues of the ragged fringe so characteristic of most species.

DOLICHOPUS FLAGELLITENENS, n. sp. ♂.

Length 5 mm.; length of wing 4.5 mm.

Rather dark metallic green. Palpi yellow, black at their tips. Face about the normal breadth for a male, overlaid with yellowish gray dust. Antennae of medium size; first joint yellow, with the usual black hairs conspicuous; second joint yellow with its dorsal half black; third joint small, rounded, black, blunt anteriorly; arista rather robust, blackish with short white pubescence. Front metallic green with coppery reflection; cilia of the inferior orbit short, yellow. Thoracic dorsum dusted in front with white, the median line coppery; humeral callosity concolorous with the dorsum. Scutellum with a large coppery spot on each side of the median line. Pleurae dull metallic green dusted with white posteriorly. Tegulae with black cilia. Abdomen with coppery reflection; venter overlaid with white dust; hypopygium black, lamellae of moderate size, suboblong, white, upper edge infuscated and fringed with rather weak black hairs. Fore coxae yellow, blackened only at their bases; beset in front with several long and conspicuous black setae; posterior coxae concolorous

with the pleurae, their tips only yellow; the median pair fringed, like the fore pair, with black setae. Legs yellow; fore tibiae provided with a few prominent black setae; tarsi 1½ times as long as the tibiae; first and second joints attenuated, stalk-like, both together equalling the tibiae in length; second joint thinner than the first and about ⅔ as long; third and fourth joints of about equal length, both together about half as long as the second joint. The fourth joint, which is yellow at its extreme base, but otherwise black, is broader than the third joint; fifth joint flattened out into a large oval black disk, densely fringed on its anterior edge with short black hairs and provided with a small and inconspicuous tuft of silvery hairs near the insertion of the claws. Median femur with a preapical bristle; tibia with rather prominent black spines; tarsus plain, blackened from the tip of the first joint. Hind femora eciliate, with preapical bristle; hind tibiae distinctly incrassated; apical half black; setae prominent; a rather dense covering of shorter black hairs, especially on the inner face, which presents a smooth streak longitudinally coextensive with the black coloring; hind tarsi black, metatarsal joint a little thickened; its extreme base yellow. Halteres yellow. Wings more brownish than grayish hyaline; veins dark brown; costa slightly thickened where it meets the first longitudinal vein; fourth vein presenting the usual double flexure; posterior cross-vein meeting the fifth longitudinal vein at right angles.

HABITAT: Milwaukee Co., Wis.

This species is related to several North American dolichopodes. In general appearance it approaches *D. batillifer*, Loew, from which it may, however, be very readily distinguished by the color of the antennae, tegular cilia and hind femora. The dilated fifth tarsal joint of the fore foot is in my species deep velvety black, whereas in *batillifer* it is more brownish and covered with minute silky hairs which make it resemble a silver reflector when viewed from the proper angle.

In the color of its hind tarsi *D. palaestricus*, Loew, approaches *flagellitenens* more closely than does *batillifer*. Loew's species, however, has entirely black antennae, pale tegular cilia and entirely yellow hind tibiae. Both *batillifer* and *palaestricus* have the hind femora ciliated, the former more abundantly, the latter less so, while the hind femora of *flagellitenens* are eciliate.

DOLICHOPUS HENSHAWI, n. sp. ♂.

Length 5—5.5 mm.; Length of wing 5—5.5mm.

Metallic green, changing to coppery and violet. Palpi pale, blackened at their ends. Face rather narrow, overlaid with ochre-yellow dust. Antennae small, reddish yellow; basal joint smooth on its under surface, the black hairs on its upper surface, as also those on the second joint, stiff and rather conspicuous; third joint small, smooth, not much flattened, ending in a short, acute point; apical half black; arista robust. Front metallic violet, moderately shining; cilia of the superior orbit black, those of the inferior orbit yellow. Thoracic dorsum resplendent coppery green, passing into violet on the scutellum; pleurae metallic green, subdued by a layer of silver gray dust. Cilia of the tegulae black. Abdomen with resplendent cupreous reflection especially in the median dorsal line; hypopygium black with dull metallic green base, and pale yellow lamellae and internal appendages; the former are quite large and shaped like isosceles triangles with rounded angles; the two sides forming the apical angle by which the lamella is attached are not infuscated though fringed with a few short and weak yellow hairs; the two other angles are narrowly

blackened and fringed with rather coarse black bristles as is also the side included by them. Fore coxae pale yellow, their extreme base, only blackened; posterior coxae for the most part concolorous with the pleurae and covered with the same silver-gray dust; on their tips, however, this dark coloring passes into pale yellow. The anterior coxae are covered on their fore faces with black hairs, some of which are long and conspicuous, though a greater number are short and evenly distributed.

Legs pale yellow; apical sixth of fore tibia somewhat incrassated, blackened and provided with several prominent flattened black hairs on its anterior face. These hairs are so graduated in length as to make the tip of the tibia seem more incrassated than it really is. Fore tarsus $1\frac{1}{2}$ times as long as the fore tibia; first joint about $\frac{1}{2}$ as long as the tibia, blackened at its tip, its base on the anterior side bared of the small black hairs which cover the joint; hence, at first sight, this joint seems to have a pale spot where it joins the tibia; second joint somewhat longer than the third, second and third together about equal to the first joint; fourth joint about a third as long as the preceding joint, black, except at its base, and somewhat broader than any of the preceding tarsal joints; fifth joint considerably dilated, flattened, oval, dark brown, fringed with short black hairs on its outer edge. The claws are inserted on the middle of the inner long side of the oval; hence the dilatation of the fifth joint has not taken place, as in some other species, at right angles to the long axis of the tarsus, but obliquely. Median femur with preapical bristle; median tarsi dark brown or black from the tip of the first joint. Hind femora with short preapical bristle, ciliated on both their anterior and posterior edges. The posterior cilia are black, very long and form a series extending nearly the entire length of the posterior face; near the base of the femur, however, they become much shorter and pale yellow; the cilia of the anterior edge are all black, much shorter and occur only on the basal half of the femur. Hind tibiae somewhat incrassated with infuscated tips; the usual setae are long and conspicuous; on the inner face a dark brown band runs from the insertion of the tibia to its middle, where it ends in a point; the infuscated tip of the tibia sends out a much shorter dark brown band which stops before reaching the basal band. Hind tarsi deep black, the metatarsal joint a little thickened. Halteres honey yellow. Wings uniformly grayish hyaline with brown veins; costa slightly thickened where it meets the first longitudinal vein; fourth longitudinal vein not broken, but exhibiting the usual double flexure; posterior cross vein meeting the fifth longitudinal vein nearly at right angles.

HABITAT: Massachusetts.

This species may be easily distinguished from all described North American species of *Dolichopus* by the peculiar coloring and conformation of the fore feet. The descripiton is taken from three males sent me by Mr. S. Henshaw.

DOLICHOPUS GERMANUS, n. sp. ♂. ♀.

♂ Length 4.—5 mm.; length of wing 4.—4.5 mm.

Metallic green, not very bright. Palpi pale yellow, face rather narrow, silvery white. Antennae of the same shape as in *D. variabilis*, smooth, red; first joint rather long, cuneate; second joint short and broad; third joint of moderate size, about as broad as long; apical half infuscated, ending in a short but acute point; arista inserted on about the middle of its dorsal contour. Front subdued metallic green; cilia of the superior orbit black, on the inferior orbit dirty white. Thoracic dorsum metallic green with a golden reflection, dusted in front with yellowish scales; pleurae metallic green, becoming pearly from a covering of white

dust. Cilia of the tegulae black. Scutellum concolorous with the thoracic dorsum. Abdomen metallic green, passing into cupreous on the apical half; venter dusted with white, its short hairs pale yellow; hypopygium large, black, with metallic green reflection on its basal half, thinly covered with white dust; penis and internal appendages pale yellow; lamellae white, of moderate size and irregularly trigonal shape; apical margins rather broadly bordered with black and broken into a jagged fringe of bristles, which seem to be white with black bases. From the posterior edge of each lamella projects a broad, flat, bifurcate bristle. Coxae and legs pale yellow; the latter dusted with silvery white dust. Fore coxae covered with short white hairs anteriorly and bearing several conspicuous black bristles near their tips; the median coxae have, besides a few long and curved black hairs on their anterior faces, a long and straight black seta on the lateral face near the tip and a brown spot at the base; hind coxa near its tip with a black bristle which is only about $\frac{2}{3}$ as long as the corresponding one on the median coxa. Fore tarsus plain, about $1\frac{1}{2}$ times as long as the fore tibia, the last joint but very slightly, if at all, dilated, black, contrasting with the pale yellow of the other tarsal joints. Posterior femora each with a prominent preapical bristle; the hind pair eciliate; the black bristles of the posterior tibiae well developed and conspicuous; median tibiae with four equal setae at their tips; posterior tarsi blackened from the tip of the first joint; usually on the median pair the second joint and the tip of the first are more dark brown. Halteres pale yellow. Wings hyaline, with a brownish tinge; narrow at their bases and somewhat pointed at their apices; veins yellow; one or both of the angles of the double flexure in the fourth longitudinal vein somewhat more acute than in many species of *Dolichopus*. The posterior cross-vein, though perpendicular to the fourth longitudinal vein, forms an angle less than 90° with the fifth longitudinal vein.

♀. Length 4.5 mm.; length of wing 4.5 mm.

Face twice as broad as in the male. Third antennal joint infuscated to a less extent and ending in a slightly shorter and blunter point. The terminal joint of the fore tarsus seems to be a little narrower than in the male, though it is also accentuated with black. Otherwise the female very closely resembles the male.

HABITAT: Milwaukee Co., Wis.

I have examined 15 males and 18 females of this species and, with a single exception, find the coloring approximately constant as I have described it. The species is closely allied to Loew's *D. variabilis*, in whose company I have several times taken it. The males of the two species may, however, be readily separated by attending to the following points:

*D. variabilis*: Face yellow; cilia of the tegulae yellow; fore tarsi blackened from the tip of the first joint; hind femora ciliated.

*D. germanus:* Face white; cilia of the tegulae black; only the terminal joint of the fore tarsi black; hind femora eciliate.

The pale hairs on the venter of the male specimens of *variabilis* in my possession are very much longer than in *germanus*. The hypopygial lamellae, too, have a different outline and more jagged edge with several flattened bifurcate bristles. The females of the

two species differ, as is the rule in the genus, much less than the males. The female *variabilis* has pale cilia on the tegulae and the fore tarsus blackened from the tip of the first joint, whereas the female *germanus* has black tegular cilia and only the terminal joint of the fore tarsus black. I have seen one female, the exception above alluded to, that had half of the tegular cilia yellow, and half of them black.

I am quite certain that the female *germanus* was known to Loew. He says, after mentioning the fact that *D. variabilis* is more variable in the coloring of the posterior tarsi than is usually the case with the species of the genus *Dolichopus*: "I possess also some other females which I can only distinguish from the above described ♀ of *D. variabilis* by their black ciliated tegulae. It seems therefore that either the females vary in the coloring of the cilia, or that we have here two exceedingly similar species." Loew with his usual care and circumspection did not venture to describe these females as a new species.

(*To be continued.*)

## NOTES ON THE STRUCTURE AND HISTORY OF HAEMATOBIA SERRATA.

BY JOHN B. SMITH, NEW BRUNSWICK, N. J.

During the summer of 1889 the alarm occasioned by the appearance in excessive numbers of this species, known as the "Horn Fly," induced me to study some of the structures rather carefully to demonstrate the impossibility of injuries such as were charged to the fly. The result of these studies appeared in popular form in Bulletin 62 of the New Jersey Experiment Station, and as they cover some ground not heretofore trodden, I give some of them in a more technical and condensed form to the entomological public.

The mouth parts were more particularly studied — not so carefully as the studies made on some other species by Dr. Dimmock, but simply to show the gross anatomy. In this species the opercular sheath is a ringed structure, enlarged basally and roughly shaped like an "Indian Club." The tube is not complete, but there is an infolding above and in front of the sheath which, while making it practically tight, gives a wide range of motion in enlarging and and contracting. On the outer side this sheath is furnished with rather sparse hair set into deep pits, evidently tactile and specialized, and not mere pubescence. In general structure *Stomoxys calcitrans* which was studied

comparatively, agrees with the present species so far as the sheath is concerned.

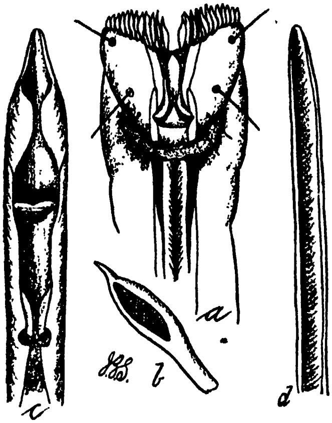


FIG. 1.

Toward the tip the sheath becomes narrower and more closely infolded until just below the labellae a chitinous, curved, cross piece unites the two sides and makes the tube complete. Chitinous rods, quite heavy at their point of inception at this cross piece run upward close to the margin of the incurved edges, gradually losing themselves in the body of the sheath. *S. calcitrans* has a very similar structure. The extreme tip is somewhat tumid, smooth, set with a few tactile hairs and furnished toward the back with a series of fleshy processes which are apparently sucker discs, being hollow with an oval opening at the side near the tip. Centrally there is an elongate, somewhat trigonate opening, with corneous edges through which the hypopharynx (lancet) and perhaps the canula (lancet sheath) are extended when the insect pierces its prey; the soft lips with the fleshy suckers form a close union with the punctured surface.

*S. calcitrans* differs very decidedly in the structure of the tip, the lips not being tumid while the edge is completely encircled by the sucker discs.

The canula or axis piece or lancet sheath, carries the hypopharynx or true lancet. It is rather more than half a cylinder to near the tip, where there is a beautiful adaptation to hold and stiffen the lancet. The open sides of the canula

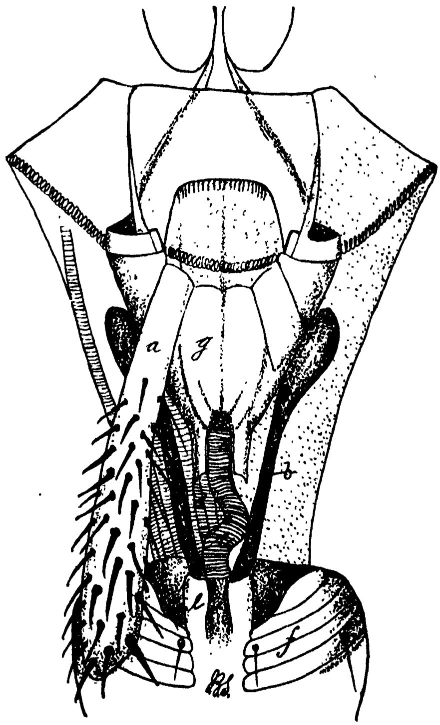


FIG. 2.

are for a short distance almost contiguous then again widely open, showing a transverse septum rising to half the

height of the cylinder, with a central trigonate nick to guide the lancet, and finally again the tube is almost completed just before the tip. This tip has exactly the shape of the opening at the tip of the opercular sheath and fills it completely. It is perhaps questionable whether this organ is used in piercing or is even inserted into the wound. The hypopharynx or lancet is a simple half tube. In *Stomoxys calcitrans* the structure of the canula is different and much more simple, being uniform until just below the extreme tip and there the tube is completed.

The opercular sheath contains considerable muscular and other structure which was not studied. From the base of the hypopharynx a ringed tube leads direct into the fulcrum which is the sucking or pumping organ. From the base of the canula on each side the "great tendons" of Macloskie extend along the side of the fulcrum nearly to the top. These are according to Dimmock "the remnants of the basal chitinous supports of the maxilla." They are securely attached to the canula and I could not find any point of attachment at the other extremities. In separating the parts of the mouth they always remain attached to the canula. In specimens mounted in balsam no muscular structure is observable attached to them. The fulcrum is funnel shaped as shown in the figure, and to the upper margin the very long heavy palpi are attached. In *Stomoxys calcitrans* the fulcrum is quite different in shape, quadrate conic rather than cylindric, the very small palpi attached to the frontal lateral supporting rods rather close to the lower part of the fulcrum and therefore essentially different in location and more like *Musca*.

The palpi in *Haematobia* are quite densely set with stout spinous hair.

Dr. Macloskie is studying *Stomoxys* and *Haematobia*, and he will undoubtedly be able to complete and elaborate this rough outline structure.

In examining the wings I noticed a

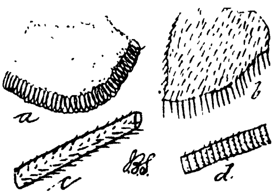


FIG. 3.

curious difference between the main wing and the alar appendix. The former is of the common membranous structure clothed with very fine pubescence, the margins ciliated and not thickened. The appendix shows no pubescence but is minutely and rather densely punctulate. The margin is formed by a spiral, coil-like tracheate structure. The veins also show differences in structure. The main trunks are complete, continuous tubes set with fine, rather short hair. The auxilliary veins which do not reach the base, and some of the transverse veins, are distinctly ringed and segmented, the segments set with transverse rows of minute hair. Whether this indicates the original tracheate nature of these veins I cannot say.

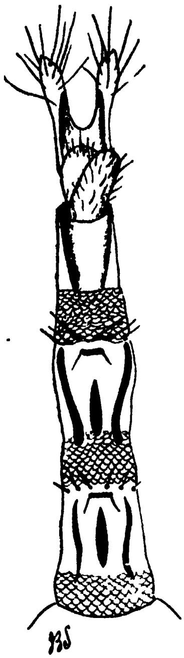

FIG 4.

The extensile oviduct of the fly is a very pretty object when fully spread out under the microscope. It is seen that at each segment is a broad belt of closely laid scales and that strong chitinous rods support the tube and probably aid in the expulsion of the ovum.

I have examined this organ in a number of diptera and find it different in detail in each species.

The genitalia of the male are quite complicated, and in this species comparatively

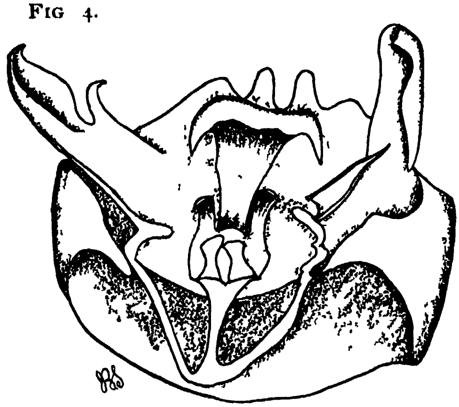

FIG. 5

larger and more easily studied than in *S. calcitrans* or in *Musca domestica*, both of which differ very decidedly from our species. The figure is from a camera drawing and no attempt has been made to symmetrically arrange the parts. The broad uncus with its spreading and elongated lateral angles at tip is supported at base by two smaller processes with rounded, curved tips. The harpes are membranous rather than chitinous, and are only apparently dissimilar, the hook like process of the left figure being concealed on the right. So the accessory clasper at the base of the right harpe is not shown on the left, though it is also present. A close study of these organs in the diptera will undoubtedly show many interesting structures.

The mouth parts of the larva were also studied and the figured structure was presented. The outward appearance is that of a ringed lip with a central opening behind which rise the fleshy eminences which bear the small palpi. The lips are made up of the usual tubular structure, the margins open and giving the appearance shown at 3 in figure 6. It seems there as if the tubes were made of an endless piece of structure the material being drawn from one to the other. When properly treated the tissue becomes transparent and the chitinous sucking or pumping stomach is brought into view, lying mostly within the first segment. This organ is roughly six-sided, three of the plates distinctly chitinous, the others more membranous and furnished with powerful muscles—in fact muscular bands are attached at all angles of this structure and thus the pasty mixture upon which the larva subsists is drawn into the stomach.

The fly oviposits, in my experience, largely at night, though the observations made under Prof. Riley's direction prove that many are also laid during the day. Flies in captivity always oviposited for me at night only. I never was able to see in the field a single fly on fresh droppings during the day, while eggs were easily found on these one day old. No amount of negative result can counterbalance positive observation, but I still believe that eggs are largely laid at night, in New Jersey at least. Observations made by Mr. Bodee of Freehold are confirmatory of this view. The fly hibernates in the imago state, and in a winter like the one just past, breeds nearly all the time, remaining quiet in stables and wherever it finds shelter only in really cold weather. Dr. Lockwood bred the flies in February from droppings brought in from the fields.

It is a rather curious phase in the history of this fly that up to the beginning of August it seems to increase enormously, fairly swarming about the cattle, — worst perhaps in June and early July, — while they are scarcely annoying after the middle of August and hardly as abundant as *Stomoxys*. It seems also that early in the year they congregate about the base of the horns of cattle much more than they do later in the season.

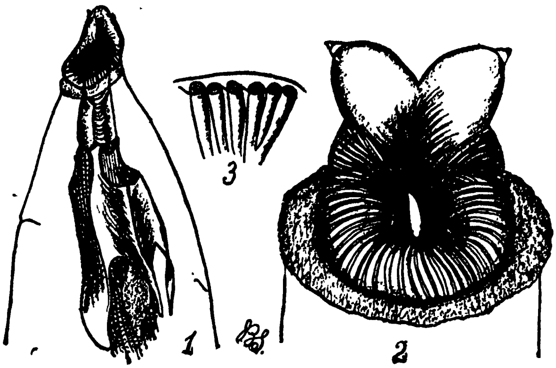


FIG. 6.

**Fig. 1.** *a*, Tip of opercular sheath; *b*, a single sucker disc; *c*, tip of canula; *d*, tip of hypopharynx: all enlarged.

**Fig. 2.** *a*, Palpus — The corresponding organ of the opposite side is omitted; *b*, the "great tendons"; *c*, throat; *d*, muscular bands to direct the proboscis; *e*, base of canula; *f*, base of opercular sheath showing ringed structure and tactile hairs; *g*, the fulcrum: enlarged.

**Fig. 3.** *a*, Alar appendix; *b*, piece of wing; *c*, piece of trunk vein; *d*, piece of transverse or auxilliary vein: enlarged.

**Fig. 4.** Oviduct of female: enlarged.

**Fig. 5.** Genitalia of male: enlarged.

**Fig. 6.** *1*, Head and anterior segment of larva showing structure of pumping stomach: *2*, mouth, further enlarged; *3*, tubes of lip still further enlarged.

## NOTES ON THE SOUTHERN DISTRIBUTION OF SOME COMMON BUTTERFLIES

There seems to be a little uncertainty as to the proper Southern range of some of our otherwise well-known butterflies, and so possibly the following notes, though coming from only a limited locality, may help to add a link in the chain of life history of our lepidoptera.

CHRYSOPHANUS HYPOPHLAEAS: In the month of August 1889, I found this fairly abundant in the neighborhood of Caesar's Head, S. C. These agree with New Jersey

examples in my collection. I found them along roadsides bordering fields, and sometimes in the wet sandy roads where mountain streams crossed. In Columbia, S. C., this past autumn, I found *C. hypophlaeas* quite common, frequenting the open meadows and weedy fields, and appearing frequently on the college campus. They presented the same quick nervous flight that I have observed in the species elsewhere and which is characteristic of the Theclas rather than our forms of Lycaena. My first acquaintance with them here was in October, and they continued abundant until late in December. They were on the wing late in February, apparently a fresh brood, and during March were quite plentiful. As yet, however (8 April) there seems to be but the one brood, the unseasonably cold weather in March having doubtless affected them. I am unable to give any information about the number of broods. I have never seen it near Charleston.

NEONYMPHA CANTHUS: This species is given by all authors as northern and western.

While collecting Catocalas in September, 1889, in a thick swamp in Clarendon county, S. C., near the Santee River, I came to a spot where a ray of sunlight penetrated the thick foliage far overhead; and there, in the glow, were a great number of the Wood Ringlet, *Debis portlandia*, having a game of "Toucher," or "Hide-and-seek" with one another. I stood watching their gambols for some time, until I thought that one of their number seemed smaller and otherwise different from the rest; in a moment he lit close to me, and I saw to my surprise, that it was something entirely different, and at the moment I could not place it. That was enough however, and I started to capture it; but the game was not in my own hands; at the first movement, off he went jerking in and out among the cypress knees and live oak buttresses for some distance, and becoming invisible when he lit. Capture on the wing seemed the only possible means of securing him, and so off I dashed, into tree-trunks, splashing through water and occasionally falling flat in the mud, over a concealed root, but the last time I fell, my net was over my prize, which proved to be *Neonympha canthus;* after considerable beating about, I started another, whose final capture was effected after a repetition of my first chase.

These were the only two seen, though I hunted the same swamp for the next day. An early departure prevented further search. This capture seemed strange, for that especial swamp has been a favorite hunting ground of mine for over eight years, and has been searched thoroughly by me.

These two are much darker, and of a gray rather than a brown tint, when compared with Maine examples in my collection, and also with Mr. Scudder's admirable figure. This is the only instance to my knowledge, of the occurrence of the species anywhere in the southeastern states.

*Ellison A. Smyth, Jr., Columbia, S. C.*

THE GENUS ARGYNNIS. The reprint (PSYCHE v. 5, p. 308-317) of Mr. H. J. Elwes's observations on the North American Argynnides did not include the table of synonyms, list of localities and other interesting matter. Mr. Elwes will be glad to send a separate of his paper to anyone desiring to study his views more fully than can be done from the reprint in PSYCHE. His address is Preston House, Cirencester, England.

HABIT OF VESPA. In PSYCHE v. 5, p. 54, Mr. J. H. Emerton figures a wasp, apparently *Vespa maculata*, hanging by one leg devouring a fly. When I read his account, I could hardly believe that so singular a position could be usual, and was therefore much interested in observing the same thing here in Colorado last year. On 24 August, near Willow Creek, Custer Co., Col., I found a *Vespa maculata* devouring a fly in exactly the same attitude as figured by Mr. Emerton. It was hanging from the edge of the roof of a house.

*T. D. A. Cockerell, West Cliff, Col.*

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 170.**

JUNE, 1890.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

[Entered as second class mail matter.]

# THE LIFE-HISTORY OF SEIRARCTIA ECHO.

BY ALPHEUS SPRING PACKARD, PROVIDENCE, R. I.

In Entomologica Americana for August, 1889 (vol. 5, p. 153-155), Mrs. Annie Trumbull Slosson gives an interesting account of the occurrence of *Seirarctia echo* Abb. and Sm. in Florida, notes its habits and adds a description of the fully grown caterpillar, prepared by Mr. H. Edwards. She kindly sent me the eggs from Ormond, Fla., on the eve of my departure to Europe for the summer. These Mr. Joseph Bridgham kindly raised for me, and made excellent enlarged colored sketches of the larva in its different stages. As these are evidently faithful studies, and as Mr. Bridgham has drawn under my direction the early stages of other arctians, I think it will be safe to describe them from his drawings, although unfortunately none of the caterpillars were preserved in alcohol. The eggs are laid in Florida on the dwarf palmetto (*Sabal palmetto*); my specimens were fed on lettuce.

*Stage I.*—Length 2½-3 mm.. Head nearly as wide as the thickest part of the body, being but slightly narrower than the prothoracic segment; in tint, dark brown, rather darker than the body; rounded. Body of the same thickness from the 1st thoracic to the 8th abdominal segment. A transversely sublunate dorsal plate or rudimentary "conical shield" on the prothoracic segment bearing on the front edge a slightly curved row of six moderately large piliferous warts; behind which is a tranverse row of smaller ones; the spinulate hairs arising from the larger warts are very long and project over the head. Behind this plate on each side is a single piliferous wart; farther down in front are two adjoining warts, and still farther down is another group of two similar warts.

The warts on the meso -and metathoracic segments are similar in shape, size and position. On each side of each segment is a group of three large warts, two of them coalesced, the third one below the others. On abdominal segments 1—8 there are two rows of small dorsal warts, two to each segment, which are *not present on the thoracic segments*. The arrangement of the subdorsal warts is the reverse of that of the two hinder thoracic segments; of the two sets of warts on each segment, the upper or dorsal is a single large one, and the two coalesced ones below are in the same position as the lower single one of the 2d and 3d thoracic segments. Lower down are three lateral rows of

piliferous warts, there being three warts on each segment; those of the uppermost row (each situated behind a spiracle) are the largest and arranged obliquely; those of the middle row are crescent-shaped; while those of the third row are minute and situated at the base of the legs, or in corresponding places on the apodal segments. It is to be observed that *the arrangement of the warts on the 8th segment is exactly the same as on the seven segments in front of it.* On the 9th segment there are two large subdorsal groups of three coalesced segments, the area either one of them occupies being the same as that covered by one of the double warts on the 2d or 3d thoracic segments. The suranal plate is roughened with crowded warts. The body is pale vandyke brown, the warts darker. The hairs are nearly twice as long as the body is thick, being long and sparse.

*Stage II.*—Length 4-5 mm. The head is a little smaller than before, but the body is of the same shape; the warts on the prothoracic shield are less pronounced, and the warts on the rest of the body preserve the same arrangement as before, but are decidedly smaller. The body is slightly more reddish in tint.

*Stage III.*—Length 7 mm. The head is now slightly narrower in proportion to the width of the body than before. There is now a great change in the nature of the piliferous warts, and a marked increase in the number of hairs. The prothoracic shield shows a tendency to divide into halves. The primary piliferous warts have undergone a differentiation so that the surface has become covered with small secondary piliferous warts each bearing a hair one-half shorter than those of the preceding stages, so that the longest ones are about as long as the body is thick; the hairs are thus arranged in thin tufts or verticils. The two compound warts on the 9th abdominal segment are larger than before. The arctian features thus seem to be assumed in the third stage.

*Stage IV.*—Length 10-11 mm. The head is slightly smaller in proportion than before and now differs much in mode of coloration; there is a median pale stripe from the the vertex to the front; the clypeus being pale, and connecting with a broad lateral pale band.

The prothoracic shield is now completely divided by a median line. The piliferous warts are somewhat smaller than before, but the hairs are of the same length. The position of the dorsal warts on the 2d and 3d thoracic segments have somewhat changed their position besides being smaller. They are arranged in a slightly curved line across the segment. The four dorsal ones on abdominal segments 1-8 are arranged more in a trapezoid than before. The two dorsal warts on the 9th segment are now about half as large as in the preceding stage. The general color of the body is more reddish than before, with a slight chestnut tint.

*Stage V.*—Length 15-16 mm. (Evidently underfed.) The head is marked as before, but the body is

considerably thicker. The markings of the body have materially changed. The prothoracic shield, in the two last stages split in two longitudinally, is now also split tranversely, so that it is represented by four transversely narrow piliferous warts. On each succeeding segment there is a transverse dorsal broad black-brown band, which encloses a yellowish white narrow stripe, which in the middle and at each end enlarges into a round spot; there are ten such curious whitish stripes on a blackish ground, which only extend part way down the sides of the body toward the spiracles. The piliferous warts are not so pronounced as in the preceding stages, while the body and hairs are of a pale chestnut hue.

*Stage VI and last.* — Length 23-24 mm. (Evidently underfed, Mr. Edwards's specimens measuring 52 mm.). In the final stage the head is pale chestnut, with no black portion. The top of the body is now black, and each segment except the first behind the head bears two transverse white stripes, one in front and the other behind a transverse chestnut-red band, enclosing the piliferous warts, which are much more prominent than in the 5th stage. Of the two yellowish white transverse stripes, the one on the front of the segment is divided into a central dot with a separate slash on each side; the hinder band consists of three portions, a central dot, from which a stripe passes each side, and instead of ending in a dot, makes a loop or hook. Our drawings made by Mr. Bridgham agree well with Mr. Edwards's description.

It thus appears that the markings of the two last stages of this larva are very different from those of any genus whose larval history is known to us; Mr. Edwards has pointed out its relations to the larva of Arachnis and Ecpantheria, with which we are not familiar.

## TWO SPECIES OF AESCHNA.

BY HERMANN AUGUST HAGEN, CAMBRIDGE, MASS.

I. Aeschna sitchensis.

*Aeschna sitchensis* Hagen, Syn. Neur. N. A. 119, 1.

Blackish-brown, spotted with blue; head yellow in front, anteriorly with a narrow transverse black line; superiorly a large black spot in the shape of a T, nearly or entirely connected each side with a black band before the eyes, forming two yellow spots surrounded with black on the superior part of the front; rhinarium and border of the labrum black; eyes largely connected; occiput yellow, hind border elevated, black on each side; thorax fuscous, dorsum with two median elongated points; sides

darker with two maculose narrow, very angular stripes, whitish blue; abdomen long, slender, equal, very much arcuated behind the inflated base in both sexes; brown spotted with blue; segments 3-10 with two large, apical blue spots, 3-7 with two basal blue spots; second segment with two blue lines on each side; appendages (♂) black, moderate, a little incurved, foliaceous, the base narrow, finely denticulated on the inner margin; carinated within, before the apex the carina is inflated and finely spinulose; the rounded apex has a very short, acute, incurved spine; inferior appendage one-half shorter, elongately triangular, obtuse; appendages (♀) foliaceous, broad (only the basal part is known). Genital parts in the second segment (♂) similar to those of *A. septentrionalis*, but the outer spine of the anterior piece is longer than the hamulus, slender, the tip sharp and curved downwards; hamuli foliaceous, flat, cut straight on the tip; feet brown, black beneath; wings hyaline, costa yellow; pterostigma elongated, fuscous; membranule brackish gray; the subnodal sector sometimes not bifurcated; 15-18 antecubitals, 8-11 postcubitals. Length 55-58 mm.; alar expanse 78-83 mm.; pterostigma 4 mm.

HAB. Sitka, Alaska; Saskatchewan, Brit. Amer.

I have seen three males and two females. In my Synopsis an imperfect female was described; this species is very similar to *A. septentrionalis* but differs in the genital parts of the male, the longer connections of the eyes, the color of the front, and the slender abdomen. *Aeschna minor* Rambur, quoted in the Synopsis, p. 20, as very similar, belongs to *A. janata* Say.

II. AESCHNA SEPTENTRIONALIS.

*Aeschna septentrionalis* Burm. Handb., 1839, v. 2, 839, 11.—Hagen Syn. Neur. N. A., 120, 2.

Blackish-brown, spotted with blue; head yellow in front; anteriorly a narrow transverse line, superiorly a large spot in the shape of a T; the rhinarium and margin of the labrum black; eyes shortly connected; occiput large, yellowish, the hind border elevated, black on each side; thorax fuscous, dorsum with two median elongated points; sides darker with two narrow, maculose and angulated stripes, whitish-yellow; feet black, above rufous; abdomen long, stoutish, narrowed behind the inflated base (♂), black, spotted with blue; last segment blue, with a broad black median band, scarcely reaching the tip; an elevated basal tooth above (♂); appendages brownish black, moderate, a little incurved, foliaceous, the base narrow, a basal obtuse tubercle beneath; carinated inwardly, apex obtuse inflated in front; inferior appendage one half shorter, elongately triangular, obtuse; genital parts in the second segment (♂) with the anterior piece elevated; strongly depressed in the middle, with a conical, straight, stout spine, as long as the hamulus on each side; hamuli foliaceous, cut obliquely on the tip with the outer angle rounded, the interior part is bent up suddenly, large, triangularly shaped on the base; penis with a hook on

the antepenultimate segment; appendages (♀) short (3 mm.) foliaceous, broad, obtuse, wings hyaline, costa yellow; pterostigma elongated, fuscous; membranule blackish gray; the subnodal sector sometimes not bifurcated; 13-16 and 18 antecubitals; 10-12 postcubitals; 4-5 areoles beneath the pterostigma. Length 51-60 mm.; alar expanse 74-86 mm.; pterostigma 4 mm.

HAB. Labrador; Fort Resolution and Saskatchewan, Brit. Amer.; one ♂ White Mountains, N. H.

This species is very much like *A. borealis* from Europe; I am not able to separate the males, except that the T spot on the front has a larger and more rounded head in *A. septentrionalis;* the appendages of the female are more widely separated at the base, less broad and somewhat incurved in the European species. I consider the two species as local varieties, but owing to the obvious difference in the appendages of the females it seems more prudent to keep them separate for the present. I have compared 15 specimens of *A. septentrionalis* and 9 specimens of *A. borealis* from Lapland, Sweden, Silesia and Switzerland. Both are arctic species. Many years ago I saw a specimen from the Wilui River, Siberia, but this specimen is not at hand and as at that time I believed *A. sitchensis* to be the same species I am unable now to say if the Siberian specimen belongs to *A. borealis.*

## DESCRIPTIONS OF SOME NEW NORTH AMERICAN DOLICHOPODIDAE.

BY WILLIAM M. WHEELER, MILWAUKEE, WIS.

(*Continued from p. 343.*)

GYMNOPTERNUS POENITENS, n. sp. ♂

Length 2.75 mm.; length of wing 2.75 mm.

Dark metallic green. Face moderately broad, covered with hoary dust. Antennae black throughout, third joint large and of the usual shape, somewhat pointed and covered with conspicuous whitish pubescence; pubescence of the arista, which is inserted in the middle of the dorsal contour of the third joint, appressed and perceptible only with difficulty. Front rather dull metallic green; cilia of the inferior orbit white. Thoracic dorsum shining blackish green, posteriorly with a brilliant golden reflection, apparently without any traces of dust. Scutellum blackish green with a golden reflection, bearing a few black hairs besides the usual setae. Pleurae anteriorly metallic greenish black, posteriorly black, overlaid with hoary dust. The yellow tegulae have black cilia. Abdomen blackish green, lacking the golden reflection of the thorax and scutellum; venter black, dusted with white; hypo-

pygium black; lamellae large, elongate oval, brownish yellow, posterior edges black, irregularly crenulated and fringed with weak black bristles; the numerous smaller and moie concealed appendages of the hypopygium yellow. Coxae and legs black throughout; femora with a faint metallic green reflection. Fore legs smooth, tarsi equaling the tibiae in length; median femur with a preapical bristle, median tibia with two setae on its posterior face, separated by a distance equal to $\frac{1}{3}$ the length of the tibia; hind femur with a preapical bristle, hind tibia with four or five spines along its posterior face. Halteres pale dull yellow. Wings smoky gray, becoming almost black along the costal margin; veins black, the third and fourth longitudinal veins gently converging and, for a *Gymnopternus*, very closly approximated at their tips. Anal angle very obtuse, giving the wing a lanceolate outline.

HABITAT: Milwaukee Co., Wis.

*Gymnopternus poenitens* is to be admitted to the group comprising Loew's *G. scotias*, *G. barbatulus*, and *G. tristis*, all of which differ from the other described North American species of the genus in having the prevailing color of the feet black. *G. poenitens* differs from *G. scotias* in having the cilia of the inferior orbit white, the feet entirely black, the hypopygial lamellae large and in great part yellow; from *G. barbatulus* and *G. tristis*, *G. poenitens* differs in the more hairy third antennal joint and its completely black legs. Both of Loew's species also have the cilia of the inferior orbit black. The course of the third and fourth longitudinal veins is very different in *G. poenitens* from what it is *G. tristis*, in which species, according to Loew, there is only a slight convergency, though he mentions in a note a male with a "considerably stronger convergency of the third and fourth longitudinal veins." He considers this specimen to be merely a striking variety of *G. tristis*.

CHRYSOTUS WISCONSINENSIS, n. sp. ♂. ♀.

Length 2.5–2.75 mm.; length of wing 2.–2.25 mm.

Splendid metallic green. Antennae entirely black; third joint small, rounded, rather hairy; eyes completely meeting on the face in the male; in the female the face broad, covered with silvery white dust, and crossed by a marked tranverse ridge a little above the oral margin. Palpi black, small and somewhat concealed in the male; considerably larger and covered with silvery white dust in the female. Front broad in both sexes, triangular, widening towards the occiput, metallic green, inclining to violet, somewhat dimmed by a layer of fine dust; cilia of the superior orbit black, those of the inferior orbit glistening white. Thoracic dorsum and scutellum bright golden green, overlaid with a thin layer of yellowish white dust, which is thickest on the humeri: pleurae metallic green, rather thickly covered with white dust, cilia of the tegulae white. Abdomen bright golden green, rather thickly covered with black hairs; terminal segments more blackish; hypopygium of the male quite large, barely concealed, appendages glistening, black. Legs quite hairy; fore coxae yellow, their extreme bases metallic green in front; their tips with a tuft of black hairs. Anterior tarsi blackened from the tip of the second joint; hind legs somewhat robust, tarsi equaling the tibiae in length, black and quite hairy, only the base of the metatarsal

joint yellow; apical third of the tibia blackened. The mature male has a rather broad metallic black band around the apex of the hind femur, leaving only the extreme tip yellow. In the female and immature male this band is represented by a more or less distinct black or fuscous spot. In the male there are several (about six) robust spines on the posterior face of the hind tibia and three less conspicuous and obliquely inserted setae at the tip of each of the four posterior femora. Halteres bright yellow. Wings grayish hyaline with black veins; the posterior cross-vein is some distance in front of the centre of the wing.

HABITAT; Milwaukee Co., Wis.

The coloring as described above is constant in five males and three females in my collection. The species is allied to *Chrysotus pallipes*, Loew. It differs in having the eyes completely contiguous in the male and not separated by a linear white face, and in having the hind legs very differently colored. In Loew's species the hind legs are yellow; "even the tarsi are only slightly dusky towards the tip." Loew's specimens could hardly have been immature individuals of *C. wisconsinensis* as I have three immature specimens which differ from the mature ones only in having the shining black subapical band of the hind femora represented by a fainter spot.

CHRYSOTUS PRATINCOLA, n. sp. ♂

Length 2.25 mm.; length of wing 2 mm.

Palpi brown; antennae black, third joint small, rounded, with apical arista. Face broad for a male *Chrysotus*, opaque black, as is also the front in my specimen. Cilia of the superior orbit black, those of the inferior orbit sparse, whitish. Thoracic dorsum, scutellum and abdomen metallic green, rendered almost opaque by a thick layer of brown dust: pleurae opaque, black. Cilia of the tegulae pale yellowish. The sparse hairs covering the abdomen dirty white. Hypopygium black, concealed; venter of a paler and more bluish metallic green than the terga. Coxae opaque black, tipped with yellow and each provided with a tuft of glistening white hairs on the anterior face; these hairs are longest on the fore coxae. Legs not very hairy; femora black with metallic green lustre, especially on the hind pair; their apices and extreme bases yellow; tibiae yellow covered with short weak black hairs; tarsi yellow, blackened on all the feet from the tip of the first joint; hind tarsi scarcely as long as the hind tibiae. Halteres honey yellow. Wings hyaline. with very faint grayish tinge; veins black; the black costa is moderately incrassated from its juncture with the first longitudinal vein to the tip of the wing; towards which it gradually diminishes in thickness; posterior cross-vein in front of the middle of the wing.

HABITAT: Saline Co., Nebraska.

The moderately thickened costa, the broad face and the coloring of the femora place this species near Loew's *Chrysotus subcostatus*. From this species *C. pratincola* may be distinguished by its very thick covering of brown dust and the pale hairs covering the abdomen. Perhaps a greater number of specimens than either Loew or I have had the opportunity to examine, may show the two species to be identical.

CHRYSOTUS CHORICUS, n. sp. ♂

Length 2. mm; lengh of wing 1.75 mm.

Bright metallic green. Palpi pale, fus-

cescent towards their bases. Face very narrow, the eyes almost meeting, covered with whitish dust. Antennae deep velvety black, first joint somewhat slender, third joint broad and hairy, ending anteriorly in a short and blunt point, above which is inserted the arista. Front metallic green, its edges at first parallel, then diverging posteriorly; cilia of the inferior orbit pale. Thoracic dorsum and scutellum bright metallic green, with scarcely any dust; pleurae greenish black, dusted with white. Tegulae with glistening white cilia. Abdomen short, cylindrical, and like the thoracic dorsum, bright metallic green, rather thickly covered with stiff black hairs; its terminal segments more blackish; appendages of the hypopygium pale, hairy. Coxae black, with yellow tips, the anterior pairs with tufts of rather long white hairs. Legs very hairy; femora shining metallic green, tips and extreme bases pale yellow; fore tibiae pale yellow; median tibiae growing blackish towards their apices. Anterior tarsi black excepting the base of the metatarsal joint, which is yellow; pulvilli not perceptibly enlarged. Hind legs more robust than the anterior, tibiae and tarsi shining blue-black; each femur with a row of black hairs, running from the base to the apex on the outer edge and increasing in length distally; hind tibiae and tarsi thickly clothed with rigid black hairs; the former with five spines on the posterior face, the latter robust, not perceptibly tapering till the fourth joint. Peduncles of halteres brown, capitula honey yellow; their tips sometimes blackened, more often only slightly infuscated. Wings grayish hyaline with black veins.

HABITAT: Milwaukee Co., Wis.

This species is related to *C. obliquus*, Loew, and somewhat more closely to *C. affinis* of the same author. It differs from both in having the cilia of the tegulae white, from *C. obliquus*, also in the hirsuteness of the hind tibia and tarsus.

CHRYSOTUS PICTICORNIS, Loew. ♂ ♀

Length 1.5–2.25 mm.; length of wing 1.75–2. mm.

Palpi pale, somewhat blackened at their bases, and clothed with a few scattered, long blackish hairs; eyes contiguous on the face in the male; face of the female moderately broad, dusted with white and presenting near the oral margin a slight swelling, on each side of which, abutting on the orbit lies a small rectangular black spot. Antennae in both sexes with the basal joint pale yellow, the two apical joints deep black, clothed with rather abundant pale pubescence; arista inserted apically. Front and occiput metallic green, dulled by a layer of yellowish dust; cilia of the superior orbit black, those of the inferior orbit glistening white, very conspicuous in some specimens. Thoracic dorsum and scutellum metallic green, considerably dimmed by a layer of yellow dust, thickest on the anterior portion and on the humeri; pleurae metallic green, inclining to blackish, dusted with white. Tegular cilia black. Abdomen coppery green, not very vivid, with the incisures narrowly blackish, the terga covered with short pale hairs which appear black in some lights and are somewhat more appressed in the female than in the male; hypopygium inconspicuous, its longer appendages pale yellow. Legs pale yellow, moderately hairy; fore coxae blackened only at their extreme bases; posterior coxae with their basal halves blackened. Tarsi blackened only towards their tips. Hind femora with prominent preapical bristle. Halteres honey yellow. Wings grayish hyaline; posterior cross vein a considerable distance in front of the middle of the wing.

HABITAT: Milwaukee Co., Wis.

Loew's description of this insect is so brief, being taken from a single imperfectly preserved specimen, that I have seen fit to describe it again. The small size of the species, the pale color of the first antennal joint, which Loew describes as red, but which is really pale yellow in well-preserved specimens, and the locality (Loew's specimen was from Illinois) are proof sufficient that my specimens are true *D. picticornis*. The species is common in damp woods near Milwaukee.

DIAPHORUS SATRAPA, n. sp. ♂

Length 2 mm.; length of wing 1.75 mm. Palpi rich brown; face narrow, covered with thick silvery white dust; antennae yellowish brown, hairy; third joint pointed (with dorsally inserted arista?) Front and occiput bronze black, with violet reflection, shifting to cupreous posteriorly, the surface covered with very fine appressed white hairs; inferior orbit thickly powdered with white dust; cilia glistening white. Thoracic dorsum vivid blackish bronze, with a shining violet patch on the disc, bordered on each side by a broad and obscurely defined cupreous band. Scutellum flattened, vivid bronze green. Pleurae bronze green, covered with silvery dust; there is a patch of thick white dust on the humerus, very conspicuous when the insect is viewed from above, and extending down to the insertion of the fore coxa. Tegulae pale yellow, with white cilia. Abdomen slender, covered with rather stout black hairs; basal segment bronze green; second and third segments pale yellow, the latter bronzed on its posterior border; remaining segments vivid blackish bronze; hypopygium brownish, scarcely protruding, covered with pale yellow hairs. Coxae and feet pale yellow, somewhat slender and not very hairy; fore coxae bearing on their anterior faces several long yellowish brown hairs; median coxae similarly adorned, one of the hairs, however, is very long and blackish; median femur with two stout blackish spines near the apex. Fore and median tarsi blackened towards their tips, the former very slightly, the latter more conpicuously. Hind legs only moderately hirsute; apical half of each femur brown on the upper face; tibiae brownish and the tarsi, excepting the extreme base of the first joint, deep brown. Halteres honey yellow. Wings more brownish than grayish hyaline, owing to the brown veins and the rather thick covering of microscopic brown hairs; posterior cross-vein very near the middle of the wing; third and fourth longitudinal veins gently curved but still parallel; anal angle not prominent as in several other species of the genus.

HABITAT: Saline Co., Nebraska.

My single specimen of this beautiful *Diaphorus* has lost the tips of the antennae and of several of the tarsi, so that I can assert nothing in regard to the insertion of the arista or the development of the pulvilli. The other form-characters, however, agree so well with those of other species of *Diaphorus* that I do not hesitate to assign it to this genus. The color of the abdomen is very unlike that of any described North American *Diaphorus*, but approaches the European *D. tripilus*, Loew, *D. hoffmannseggii*, Meigen and *D. oculatus*, Meigen, being closely allied to the latter. These European species form a subgeneric group characterized by the more or less extended yellow band encircling the base of the abdomen. Heretofore no members of

this group have been described from America; in all of Loew's species the abdomen is metallic green (or in *D. opacus* black) throughout. Loew recognized the fact that the American *diaphori* are especially heterogeneous, but with his usual fine judgment declined to resolve the genus into several. Such an attempt even at the present time, would be unwise, as I am convinced that there are still many North American species awaiting description.

DIAPHORUS PALPIGER, n. sp. ♂

Length 2.75 mm.; length of wing 2.5 mm. Palpi very prominent, as long as the face, from the insertion of the antennae to the oral margin; glistening white, golden yellow at their bases, with a few long silvery hairs on their edges. Face broad, covered with yellow dust and presenting a somewhat shallow, v-shaped depression near the oral margin. Antennae black, apical joint more piceous, hairy, twice as broad as long, reniform with subapical arista. Front and occiput broad, without any tendency to contiguity in the eyes, covered with the same glistening yellowish dust as the face; cilia of the superior orbit short and black, those of the inferior orbit very long and silvery white, forming a conspicuous, though not very dense beard when the head is seen in profile. Thorax and scutellum golden green, their brilliancy much subdued by a thick layer of yellow dust most abundant on the anterior half of the thoracic dorsum and on the lateral corners of the scutellum; pleurae greenish black, dusted with white, the yellow dust of the thoracic dorsum extending over the humeri on to the anterior pleurae a short distance. Tegulae pale yellow with yellow cilia. Abdomen metallic green, not vivid and less golden than the thorax and scutellum; intersegmental incisures narrowly black as are also the short robust hairs covering the segments; hypopygial appendages pale yellow. Coxae concolorous with the pleurae, dusted with white. Femora slightly enlarged, black on their inner and lower faces, which are dusted with white but metallic green on their upper faces; knees rather broadly pale yellow; tibiae and tarsi black, inclining to piceous at the joints; pulvilli dilated on all the feet. An even row of bristles runs the full length of the under surface of the fore femur, and a long and stout bristle projects from the anterior face of the median trochanter. Posterior legs hirsute; besides the usual short bristles clothing the tibiae, there is a row of prominent bristles on their anterior and posterior faces. Halteres honey yellow. Wings grayish hyaline, third and fourth longitudinal veins gently converging near the apex of the wing, but becoming parallel just before their termination; anal angle not very prominent; sixth longitudinal vein distinct.

HABITAT: Milwaukee Co. Wis.

This species is so different from all the species described by Loew, that no difficulty will be experienced in recognizing it. Its dark colored legs and pale tegular cilia place it in the group comprising Loew's *D. leucostomus* and *D. interruptus*. The lack of a conspicuous point to the third antennal joint immediately distinguishes it from the former, while the uninterrupted fourth longitudinal vein as readily distinguishes it from the latter.

DIAPHORUS RAUTERBERGI, n. sp. ♂.

Length 3 mm.; length of wing 2.5 mm. Palpi small, fuscous with paler edges. Face somewhat narrowed below, evenly rounded without any indication of a transverse swell-

ing, covered with coarse yellowish dust. Antennae black, basal joint short, third joint large, hairy, much shortened and expanded so as to appear kidney-shaped; arista apparently with apical insertion. Front subquadrate, together with the occiput covered with coarse yellowish dust; cilia of the superior orbit short and black; those of the inferior orbit long and conspicuous, of a yellowish tint. Thoracic dorsum, scutellum and abdomen metallic green, covered with coarse yellow dust, which is very thick on the thorax and scutellum, but much less so on the abdomen. Pleurae black, dusted with white, the anterior portions more metallic green. Tegular cilia pale yellow, appearing brown in some lights. Abdomen covered with short black hairs, which are almost lacking on the terminal segment where they are prominent in other species; hypopygium black, the tips of the concealed appendages pale yellow. Coxae black, dusted with white. Femora vivid metallic green, broadly tipped with yellow; tibiae and tarsi yellow, the latter with enlarged pulvilli on all the feet; anterior tarsi blackened from the tip of the first joint; hind tarsi brown from the tip of the first joint, only the last joint more blackish. The black hairs and spines on the legs of about the usual length. Halteres honey yellow. Wings grayish hyaline, with brown veins, which become yellow towards their origin; third and fourth longitudinal veins nearly parallel on the apical third of the wing; posterior cross-vein at about the middle of the wing; anal angle not very prominent.

HABITAT: Saline Co., Nebraska.

The peculiar configuration of the third antennal joint readily distinguishes this species from *D. leucostomus*, to which it is in most other respects closely affiliated.

PORPHYROPS LONGIPES, LOEW. ♂.

Length 3.5 mm; length of wing 3 mm. Palpi black, with a few rather long black hairs. Face narrow, silvery white; antennae black, basal joint smooth and rather slender; third joint flattened, lanceolate, a little more than twice as long as broad at the base, covered with short and even pubescence, apex somewhat rounded; arista straight, distinctly longer than the whole antenna, with appressed scarsely perceptible pubescence. Front and occciput metallic green, slightly dimmed by a layer of whitish dust; cilia of the superior orbit black, those of the inferior orbit silvery white, abundant and increasing in length towards the oral orifice. Thoracic dorsum and scutellum dark metallic green, shining sometimes with a slight cupreous reflection; the former with traces of white dust lines on its anterior part; pleurae greenish black, overlaid with whitish dust. Tegulae pale yellow with silvery white cilia. Abdomen concolorous with the thoracic dorsum, terminal segments more violaceous; the hairs with which it is rather abundantly covered are black, except on the lateral surfaces of the basal segments where they are long, tufted and silvery white; hypopygium shining black, the external appendages long and filiform, sometimes coiled up in dry specimens, pale yellow, strongly infuscated at their edges and clothed with conspicuous black and white hairs; claspers and internal appendages blackish. Coxae blackish green, tipped with pale yellow, each bearing on its anterior face a tuft of silvery white hairs, which are longest and most abundant on the fore pair. Legs hairy; the fore and medium pairs pale yellow, the former with the femora blackish green, excepting their bases and apices; tarsi blackened from the tip of the first joint; metatarsal joint of the fore feet hardly as long as the remaining tarsal joints taken together; there are several long white hairs on the posterior faces of the fore femora; median femora somewhat longer and more slender than the fore femora; hind legs elongated, femora, tibiae and basal tarsal joints incrassated, deep black with the exception of the basal halves of the femora,

which are pale yellow; the hind tarsi though incrassated at the base taper evenly to the last joint. Halteres honey yellow. Wings somewhat lanceolate at their bases, gray, with blackish veins; the third and fourth longitudinal veins at first converge gently, but on approaching the tip of the wing become parallel, the fourth terminating a very short distance in front of the tip.

HABITAT: Milwaukee Co., Wis.

The three males in my collection agree with the above description, which will be found to differ somewhat from Loew's account (Monograph, p. 340, also Centuria 5. 92). The less pigmented hind legs in Loew's specimen, taken in the White Mountains, may have been due to immaturity. I believe that my specimens represent the normal adult male, though it is, of course, possible that they may belong to a western variety with highly pigmented hind legs. Be this as it may, the differences seem hardly of specific value.

SYNARTHRUS CINEREIVENTRIS, LOEW. ♂.

To Loew the male of this species was unknown. It differs from the female as described by that dipterologist, only in the structure of the antennae and the spinulation of the legs, the coloring of my specimen answering perfectly to the color-description of the female. The first antennal joint is rather slender, especially at its base, the second overlaps the inner side of the third by a large rounded flap as in the female; the third joint is long and tapers slowly to an acute point in such a manner as to have the contour of its dorsal side remain straight or slightly concave, while the contour of its ventral edge is convex; the pubescence covering the joint is shorter and less conspicuous than in *S. barbatus*, Loew; the arista which is a little over half as long as the antenna, is rather delicate and clothed with scarcely perceptible pubescence. The spinulation of the legs in the female is not described by Loew, probably because it presented nothing worthy of remark. The male has a delicate and rather long spine projecting from the upper surface of the tip of the median femur, while there are six or seven short, stiff and evenly graduated spines before the middle of its under surface; the inner face of the median tibia has three widely separated black spines; the posterior face of each of the hind tibiae is armed with about eight equidistant black spines, besides the regular rows of shorter and smaller spines; the two spurs at the apex are powerfully developed, of equal length, and, in my specimen, directed at right angles to the long axis of the tibia; hind metatarsal joint with several prominent spines on its under surface; on the inner face of its proximal end a peculiar sickle-shaped spine, bent back in the opposite direction to all the other spines, so that its curved and pointed end comes to lie near the tip of the tibia. This peculiar spine is inserted near the middle of the metatarsal joint, to the surface of which it is applied for some little distance. The abdomen is small, with small, black, and in my specimen, much concealed hypopygium. Length 2.5 mm.; length of wing 2.5 mm.

HABITAT: Milwaukee Co., Wis.

(*To be concluded.*)

**The fossil insect localities in the Rocky Mountain region.**— No one collecting fossil insects in the Rocky Mountain region could fail of noting how close was the general resemblance of the rocks at all places where they have been found, excepting at Florissant, where the fine, tough, homogeneous shales found elsewhere give place to friable masses of ash interlarded with thin seams of hardened mud. A comparison of the insect remains shows a similar difference. The hymenoptera which abound at Florissant almost disappear in the other localities, while the coleoptera, which hold a third place at Florissant, form the larger proportion of the mass in the other deposits. To test the opinion formed by the cursory examination of specimens in the field, I have counted the specimens obtained in each of the different localities visited during a single summer, and find the opinion amply confirmed. The localities visited besides Florissant, Colorado, were Roan Mountains in western Colorado, the lower White River, Colorado, and Green River, Wyoming.

The first set of columns in the accompanying table shows the total number of specimens (regardless of species) obtained during the season's work, separated by orders, (1) in all localities; (2) at Florissant alone; and (3) in the other localities, excluding Florissant; and the second set of columns the same figures reduced to percentages. Nothing could well be more striking than the contrasts in the hymenoptera and coleoptera.

| | Number of specimens. | | | Percentages. | | |
|---|---|---|---|---|---|---|
| Orders. | All localities. | Florissant. | Other localities. | All localities | Florissant. | Other localities. |
| Hymenoptera . . . | 277 | 243 | 34 | 15.2 | 34.5 | 3.0 |
| Diptera . . . . . | 432 | 184 | 248 | 23.7 | 20.1 | 22.2 |
| Coleoptera . . . . | 806 | 104 | 702 | 44.3 | 14.8 | 63.0 |
| Hemiptera. . . . | 185 | 86 | 99 | 10.0 | 12.2 | 8.9 |
| Orthoptera. . . . | 19 | 2 | 17 | 1.0 | 0.3 | 1.5 |
| Neuroptera . . . | 90 | 75 | 15 | 5.0 | 10.6 | 1.3 |
| Arachnida . . . . | 11 | 11 | 0 | 0.6 | 1.5 | 0.0 |
| Totals . . . . | 1820 | 705 | 1115 | 99.8 | 100.0 | 99.9 |

*S. H. Scudder.*

## Entomological Notes.

Entomological Club, A. A. A. S.—The meeting of the club will be held at Indianapolis, Ind., on Wednesday the 20th of August at 9 A.M. Prof. A. J. Cook of the Michigan Agricultural College is the president.

The venerable naturalist, Prof. Felipe Poey of Havana, well known to entomologists for his valuable papers on Cuban insects, completed his ninety-first year on the 26th of last May. He still occupies himself with natural history studies, and particularly ichthyology.

The Butterflies of the Eastern United States and Canada, issued last year by the author, Samuel H. Scudder, will hereafter be published by Messrs. Houghton, Mifflin & Co. of Boston, the publishers of Edwards's Butterflies of North America.

The Rev. Seymour St. John's little book just published in England, called "Larva collecting and breeding" would better have been given simply its second title, "a handbook to the larvae of the British Macrolepidoptera and their food plants," for there is nothing in it about collecting or breeding. It is simply a list of species and their accredited food plants and the same reversed. To an American the lists seem full. The best equipped caterpillars are, for butterflies *Euchloe cardamines* which has 10 food plants, and for the moths *Acronycta alni* with 15. Some of the plants are fed upon by a very large number of different caterpillars. Thus a list is given of 104 species feeding on *Quercus robur*, *Betula alba* has 84, *Salix caprea* 74, *Crataegus oxyacantha* 60, *Polygonum aviculare* 48, and so on.

The Instituto de segunda enseñanza of Havana has just acquired the valuable entomological collections of Dr. Juan Gundlach who is still untiringly at work, in his eightieth year, on the Cuban fauna. Of his Ento-

mologia cubana Vol. 1 containing the lepidoptera was published between 1881 and 1886. Vol. 2 containing the hymenoptera, neuroptera and orthoptera is now passing through the press at the slow rate of a signature of eight pages a month and will not be finished before 1891. The hymenoptera and neuroptera are already printed. Vol. 3 will contain the remaining orders, "if" writes Dr. Gundlach, "my life dure some years more;"—which all will trust may be the case; indeed when his collections have been transferred he proposes another trip to the mountains of Guantánamo in Eastern Cuba, where he has already secured so many fine collections.

INSECTS DESTRUCTIVE TO WATER PIPES.—And now the coleopterous family *Parnidae* comes under economic suspicion. Pine-staves of the water pipes of the Ottawa (Can.) water system which have been in use fifteen years are found by Mr. Fletcher, Government entomologist, to have lost in this time one fourth of their thickness and in places, and especially at the joints, to have been bored through and through. Mr. Fletcher regards the destruction as due in the first instance to the decaying of a very thin layer of the surface of the wood through the chemical action of the river water; and then to the removal of the decayed surface by aquatic insects so as constantly to expose a new surface to the same action. Beetles belonging to the allied genera *Dryops* and *Macronychus* were found on the injured wood, and in the decayed layer were numerous tracks made by larvae provisionally referred to these same genera; none have yet been bred. Mr. Fletcher thinks their presence in such numbers may possible be due to the unusual quantity of decaying bark lying in a bay of the Ottawa River, near the inlet of the pipe, where for twenty years logs have been sorted for the lumber mills which gives Ottawa its commercial importance. It is now proposed to take the water from a point higher up the river and to use steel pipes.

HABIT OF A DRAGON-FLY.—In the Journal of the Bombay natural history society (v. 4, no. 3), Mr. E. Giles records a curious fact which ought to have some interest for entomologists. In June 1888 he was standing one morning in the porch of his house, when his attention was attracted by a large dragon-fly of a metallic blue color, about 2½ inches long, and with an extremely neat figure, who was cruising backwards and forwards in the porch in an earnest manner that seemed to show that he had some special object in view. Suddenly he alighted at the entrance of a small hole in the gravel, and began to dig vigorously, sending the dust in small showers behind him. "I watched him," says Mr. Giles, "with great attention, and, after the lapse of about half a minute, when the dragon-fly was head and shoulders down the hole, a large and very fat cricket emerged like a bolted rabbit, and sprang several feet into the air. Then ensued a brisk contest of bounds and darts, the cricket springing from side to side and up and down, and the dragon fly darting at him the moment he alighted. It was long odds on the dragon-fly, for the cricket was too fat to last, and his springs became slower and lower, till at last his enemy succeeded in pinning him by the neck. The dragon-fly appeared to bite the cricket, who, after a struggle or two, turned over on his back and lay motionless, either dead or temporarily senseless. The dragon-fly then, without any hesitation, seized him by the hind legs, dragged him rapidly to the hole out of which he had dug him, entered himself, and pulled the cricket in after him, and then, emerging, scratched some sand over the hole and flew away. Time for the whole transaction, say, three minutes." *Nature*, 5 June 1890, v. 42, no. 1075, p. 135.

No. 138–140 were issued 17 March 1890.
No. 165 was issued 21 January 1890.
No. 166 was issued 14 February 1890.
No. 167–168 were issued 20 March 1890.
No. 169 was issued 1 May, 1890.

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 171.**

JULY, 1890.

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PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

[Entered as second class mail matter.]

# DESCRIPTIONS OF SOME NORTH AMERICAN CORDULINA.

BY HERMANN AUGUST HAGEN, CAMBRIDGE, MASS.

[*With Plate 1.*]

## 1. Epitheca yamaskanensis.

*Aeschna yamaskanensis* Provancher Natur. Canad. 1875, v. 7, 238; 248.

*Epitheca yamaskanensis* Prov. ibid. 1877, v. 9, 86. — Selys, 2d Add. syn. Cordul., 1878, 13, 20, 12.

Male. Olive brown; front and vertex brown, blackish pilose, strongly punctated; front excavated above; labrum yellow, labium pale; antennae blackish; vertex convex above, narrowed to tip, which is half as broad at the base, nearly straight, a little impressed; occupit yellow, brown on tip, whitish pilose behind; yellow behind the eyes, two transversal brownish marks in the middle. Thorax olive brown, densely brownish pilose; dorsum dark brown, paler olive at the humeral suture and below the blackish brown sinus; carina obscure yellowish; sides olive brown; a yellow spot around the stigma; below pale brown. Abdomen long, slender, inflated at the base, contracted on third segment, gradually broader to tip; third segment paler at base; segments 4–9 with a long yellowish spot on each side; transverse sutures black; articulation membrane yellowish; earlets moderate, dark brown, shining, round, pointed behind; last segment short, pale brown; a small dorsal carina not reaching the apical margin, which is prolonged into a triangular lobe between the superior appendages; base of the last segment notched; the articulation membrane enlarged. Superior appendages three times as long as the last segment, black, pilose, approximated, basal half cylindrical, about straight, somewhat contracted just after the base, apical half suddenly enlarged externally, a little divergent, the external border rounded, tapering to a short acute tip, recurved a little inwards and upwards; viewed from the sides, the basal half is cylindrical, a little incurvate, the apical half suddenly increased, tip recurved, acute; an obsolete external ridge not reaching the tip begins where the appendages enlarge and here on the underside is also a small notch. Inferior appendage a little shorter, light brown, triangular, large at base, very much narrowed and recurved on the apical half, ending in a blunt tip, somewhat thicker above. Genital parts on the second segment comparatively small; ventral lobe black, leaf shaped, margin thickened

externally; hook pale yellowish, long, flat, larger at base, tapering to tip which is black, recurved, sharp; penis black, first joint with a short apical spine behind, second joint stout, short, with two erected spines on the tip; last joint cylindrical, pale; elevated spoon black, small, flat, incurved. Legs brown at base, femur blackish below, tibia black, the two margins above yellow; tarsi black; the legs are long, slender, pilose, with a small brush on the tip of the anterior femora; tip of the anterior tibia, with a short membrane below, ending with a spine projecting on the tip. Wings hyaline, somewhat smoky, veins black, costa externally yellow; pterostigma dull yellow, narrow, elongate, cut obliquely on tip; below $1\frac{1}{2}$ areoles; the base of the wings orange to the arculus, except the apical half of the basilar space; the transversals in the median space and all below them are clouded with black, forming with the dull orange areoles on the hind wing a brownish looking basal spot; the three basal antecubitals in the subcostal space faintly clouded with orange; membranula long, snow-white, black at tip; the angle of the hind wing not sharp, less than rectangular; front wing with 9 antecubitals, 7 postcubitals; hind wing with 6 antecubitals, 7-8 postcubitals; triangle of front wings with 3 areoles, internal triangle empty; triangle of hind wings with 2 areoles; two transversals in the median space; two series of discoidal areoles beginning with three; anal triangle of hind wings with 1 transversal; basilar space of all wings empty.

Female. Similar to the male; abdomen a little larger on tip; last segment pale, short, apical margin straight; appendages pale brown, blackish on tip, twice as long as the last segment, pilose, cylindrical, bent a little inside after the base, pointed on tip, vulvar lamina very short, with a large rectangular notch; the lateral quadrangular lobes with the apical margin thickened; earlets wanting, a very small tubercule is visible, femur less dark than in the male; apical half of the anterior tibia with a series of pale flattened scales like spines; wings similar, front pair with 11-10 antecubitals, 9 postcubitals; hind wings with 6 antecubitals, 10-9 postcubitals; the internal triangle of the fore wings with 3 areoles.

| | *Male* | *Female* |
|---|---|---|
| Length of body with appendages | 53 | 52 |
| " " abdomen with " | 40 | 40 |
| " " ala sup. | 34 | 36 |
| " " ala inf. | 33 | 35 |
| " " pterostigma | $2\frac{1}{2}$ | $2\frac{1}{2}$ |
| " " appendages sup. | 3 | $2\frac{1}{2}$ |
| " " tibia post. | 7 | 7 |
| Breadth of caput | $7\frac{1}{2}$ | $7\frac{1}{2}$ |
| " " ala sup. | $8\frac{1}{2}$ | $8\frac{1}{2}$ |
| " " ala inf. | 11 | 11 |
| Expanse of ala inf. | 70 | 74 |

HABITAT: Mt. Yamaska, near St. Hyacinth, Province of Quebec, Canada.

The male was collected by the Abbé Provancher in 1875 and the female in 1877. There can be no doubt that both belong to the same species; the difference of the internal triangle of the fore wings, empty and without transversals in the male, with three transversals, united in the centre and forming 3 areoles as in the discoidal triangle in the female is in-

teresting, as in all the related species a lack of constancy in the venation is observed. This species is very similar to *E. obsoleta*, but the wings are narrower in proportion to the length. The other differences are given under *E. obsoleta*.

2. EPITHECA OBSOLETA.

*Libellula obsoleta* Say Journ. acad. nat. sci. Philad. 1839, ser. 1, v. 8, 28, 17: Ed Lec. v. 2, 402.

*Didymops obsoleta* Hagen Syn. Neur. N. A. 1861, 136, 2.

*Epitheca? obsoleta* Selys Syn. Cordul. 45, 25 — Hagen Proc. Bost. soc. nat. hist., 1873, v. 15, 269, 24.

*Neurocordulia obsoleta* Selys 2d. add. syn. Cordul., 1878, 28.

*Libellula polysticta* Burm. Handb. 1839, v. 2, 856, 53, ♂.[1]

*Cordulia? molesta* Walsh Proc. ent. soc. Philad. 1863, v. 2, 254, ♀.

Male. Pale dull olive brown; front and vertex pale olive, brownish pilose, strongly punctated, front excavated above; labrum yellow, labium paler; antennae pale brown; vertex convex above, narrowed to tip, which is half as broad as the base, nearly straight at the tip; occiput yellow, whitish pilose behind; behind the eyes yellow, some brownish marks in the middle, but rather small. Thorax pale olive brown, densely brownish pilose; dorsum with a darker broad dorsal stripe, shading off in the ground-color half way to the humeral suture; carina yellowish, sinus brown; a small yellow spot on each side of the dorsal stripe anteriorly near the prothorax; sides with cuneiform yellow spots around the stigmata, reaching to the bases of the legs. Abdomen long inflated at the base, contracted on third segment, gradually enlarged to tip, and somewhat depressed (in bad condition); more yellowish along the lateral border; transverse sutures black; articulation membrane pale; a round yellow spot near the border of each side of the

[1] I have always used the names of the American entomologist, Thomas Say, though I worked in Europe, and their priority over those of H. Burmeister is by no means certain. Say's paper was read 12 July, 1836; it was not published—I have never been able to learn why — until 1839. In my opinion the American entomologist can never lose priority by the unaccounted for delay in the publication of his paper.

Mr. Edward Doubleday (Mag. nat. hist., 1839, n. s. p. 141) says: "This paper [of Say] was not published when I was in Cambridge, Mass., in October, [1838] but Dr. Harris informed me that it would appear in the forthcoming volume [v. 8] of the Journal of the academy of natural sciences, of Philadelphia. . . . Epping, Feb. 18, 1839." Say's paper was therefore not published 12 February, 1839, as Doubleday prints (l. c.) a list of Say's entomological writings, by the kindness of Dr. Harris, more complete than any that has yet appeared.

The exact date of publication of the monthly issues of the Journal from v. 2 to v. 6, p. 327 is given in the Proc. acad., v. 1, p. 57–59, and concludes with the notice that "the remainder of the Journal is published in half volumes." Volume 8 has simply the date 1839. At that date Burmeister's work was certainly in print and was published directly; but as I was in Norway and Sweden, I did not see it until the fall, when in Altona, at the house of Mr. Sommer, Burmeister's father-in-law. Priority hunters here and in Europe may do their work.

second segment; earlet brown shining, round, pointed behind; last segment (base injured) with the apical margin slightly produced in the middle, rounded, very slightly depressed. Superior appendages a little more than twice as long as the last segment, pale brown, pilose, closely approximated in the apical half; basal half cylindrical, curved slowly inwardly and inferiorly; gradually enlarged externally on the apical half, and tapering to the tip, which is short acute, recurved inwardly; viewed from the side the cylindrical basal half is somewhat contracted in front of the inflation of the apical half; inferior appendage a little shorter, pale brown, triangular, large at base, very much narrowed and recurved on the apical half, tip blunt with a small black tooth above. Genital parts wanting. Ventral lobe on the second segment small, brown, leaf-shaped, margins thicker, blackish. Legs pale brown, pilose, tibia externally yellowish, spines black; tarsi pale brown; anterior femora with a small brush on the tip; anterior tibiae with a short membrane below, ending in a spine projecting from the tip. Wings hyaline, broad, principally the hind wings, veins pale brown; pterostigma elongate, yellow, below little more than one areole; the antecubitals in the subcostal space surrounded by a yellow spot, a similar spot near the arculus; transversals in the median space dark brown; hind wings with similar spots, and an orange one filling the triangle near the anal border; angle of the hind wings oblique nearly rounded; membranula long, snow-white, apical half blackish; front wing with 7–8 antecubitals, 8 postcubitals; hind wing with 5 antecubitals, 7–9 postcubitals; both triangles of front wings with 3 areoles; discoidal triangle of hind wings with 2 areoles; 2 transversals in the median space of all wings; one transversal in the basilar space of the left hind wing; discoidal areolets beginning with 3, then 2 series for 2 areolets, followed by 3 not very regular series; anal triangle of hind wings with 2 transversals.

Female. Similar to the male; abdomen more robust, lateral margin of the segments paler; last segment very short, apical margin widely notched; appendages brown, black on tip, pilose, cylindrical, narrower at base, slightly bent outwards on tip, which is short, acute; tubercule between them brown, pilose, obtuse; vulvar lamina very short, with a large rectangular notch, almost attaining its base, sides rounded. Legs brown, tibiae yellowish externally, tarsi dark brown. Wings similar to the male, but slightly smoky, the costa yellow externally, all spots larger, a brownish spot on the base of the front wings near the hind border, and a larger brown band on the hind wings, ending on the interior angle of the discoidal triangle, leaving the extreme base of the wing hyaline; front wing with 7 antecubitals, and 7–8 postcubitals; hind wing with 5 antecubitals and 8 postcubitals; both triangles in front wings with 3 areoles; discoidal triangles in hind wings with two parallel transversals, of which in the right hind wing the basal one

is furcated, giving 3 and 4 areoles; median space of front wings with 2 (left) or 3 (right) transversals; median space of hind wings with 4 (left) or 3 (right) transversals; basilar space of all wings with 1 transversal; membranula snow-white, blackish on tip.

| | Male | Female |
|---|---|---|
| Length of body with appendages | 43 | 45-53 |
| " " abdomen with " | 30 | 34-36½ |
| " " ala sup. | 31 | 34-37½ |
| " " ala inf. | 30 | 33-38 |
| " " pterostigma | 3 | 3½ |
| " " appendages sup. | 2¾ | 2½ |
| " " tibia post. | 6 | 6- 6½ |
| Breadth of head | 7 | 7- 8 |
| " " ala sup. | 8½ | 8½-10 |
| " " ala inf. | 11 | 11-13 |
| Expanse of ala inf. | 62 | 70-74 |

HABITAT: Indiana and Massachusetts, Say; New Orleans, La., Burmeister; Rock Island, Ill., Walsh; Galena, Ill., Mr. T. E. Bean. The types of Say from Indiana and the type of Walsh are destroyed. I saw the latter in 1868 and am sure that it belongs to *E. obsoleta*.

Say's type from Massachusetts, a female collected in 1820 in a meadow at Milton, near Boston, still exists in the Harris collection at the Boston society of natural history; the type of Burmeister a male and a male from Galena are in my collection. These are the only specimens known and have been in the hands of Baron De Selys Longchamps for his Synopsis. The type of Burmeister is immature and in bad condition; it was placed in *Didymops* in my Synopsis as I did not care to found a new genus on such insufficient material and therefore placed the species in the genus I believed most suitable. I was aware that the branches of the tarsal nails were unequal, but the only specimen of *D. transversa* in my possession at that time was also in very poor condition, and the omission to state the difference in the claws induced Mr. Walsh to overlook the identity of his species with that of Say. This species is very close to *E. yamaskanensis* Provancher, of which I have seen the only pair known. Considering the aberrations in the venation in *E. obsoleta* I believed after my first examination of the male, that both belong to the same species, but the discovery of the female seems to prove them different. *E. yamaskanensis* is larger, the head more globular, rather longer, occiput narrower, the wings longer but of the same breadth, the stigma shorter, the spots in the subcostal space almost wanting, antecubitals more numerous, the base of all the wings orange, legs longer, superior appendages of the male black, longer, visibly more dilated, with a small inferior notch in the middle; apical border between them prolonged into an acute recurved tip. I think it will be more prudent to accept them as distinct species until more specimens shall show intermediate forms.

3. CORDULIA LINTNERI.

*Cordulia lintneri* Hagen 2d Add. syn. Cordul. 1878, 9, 14.*

Male. Head large; labrum and labium bright yellow; face greenish

*This is *Libellula vacua* Hagen (no descr.) Stett. ent. zeit., 1867, v. 28, 91. The ♂ is figured without name by Emmons, in DeKay Agric. N. Y., v. 5, pl. 15, f. 1.

rhinarium brownish in the middle; front advanced semicircular, somewhat flattened above, roughly punctated, slightly villous with pale hairs, front edge blunt; antennae blackish brown; between front and ocelli blackish; vertex short, transversal, rounded, roughly punctated with brown hairs; occiput yellow, rather pointed before; dilated posteriorly, rounded, impressed behind; eyes large, blackish, brown behind, with long white hairs; prothorax black, posterior lobe yellow, large elliptical; thorax villous, transversally finely striated, shining; dark brown, sinus yellowish brown, the same color shaded down somewhat on each side before the sinus; part of the lateral sutures and some not well-defined spots near the legs black; beneath pale brown with large blackish spots behind the legs; abdomen short slightly villous, slender, cylindrical, the base enlarged; blackish brown, segments 1–9 with an apical yellow transversal band with the basis on the third segment, and is nearly separated in the middle of segments 8 and 9; segment 10 as long as the 9th, convex above, with a basal median impression, black, shining; apical border straight slightly bent up; abdomen blackish beneath, the border of the segments somewhat paler in the middle, and on each side of segment three; second segment contracted in the middle, on each side with a large yellow earlet, rounded externally, pointed behind. Superior appendages a little longer than the last segment, separated at their basis, approached at their tips, straight cylindrical, the basal third flattened interiorly; after the first third externally below a small tooth and following to the tip inferiorly are six smaller ones; tip rounded with the appearance of a small soft point; inferior appendage a little shorter, triangular, strongly recurved, the point truncated; the appendages are black, hairy, the superiors pale brown on the tip, the inferior in the middle; genital lobe of the second segment triangular elongated; hooks long, bent, yellow, narrowed and brown on the tip; the spoon shaped elevator of penis enlarged on tip, yellowish. Legs black, moderately long, the hind ones passing the 3d segment of abdomen; femora below rough, a large number of very short teeth; tibiae with black cilia; claws of tarsi unequal, the apical longer; femur of fore leg with a little brush on tip; tibiae of fore legs with the membranous plate; wings hyaline, a small yellow spot on the extreme base of all; veins black, costa yellow; pterostigma yellow, small, the external side more oblique; antecubitals 7; postcubitals 5–6; all triangles without transversals; there is no inner triangle on the hind wing; one series of discoidal cells, the apical half beginning with two, later more; hind wings with the inner angle nearly rounded: anal triangle broad, with a transversal vein before the tip; membrane large, grayish white, ending on the transversal vein of the anal triangle.

Female. Similar to the male; the abdomen a little stouter, more enlarged at base, less retracted on the 3d segment, no earlets, but the place a little

## EXPLANATION OF PLATE I.

*Epitheca yamaskanensis* Provancher.

Fig. 1. ♂ Anal appendages, from above.
Fig. 2. ♂ Anal appendages, side view.
Fig. 3. ♀ Anal appendages, from above.
Fig. 4. ♀ Anal appendages, side view.
Fig. 5. ♂ Genitals in the second segment.
Fig. 6. ♀ Vulva, from below.

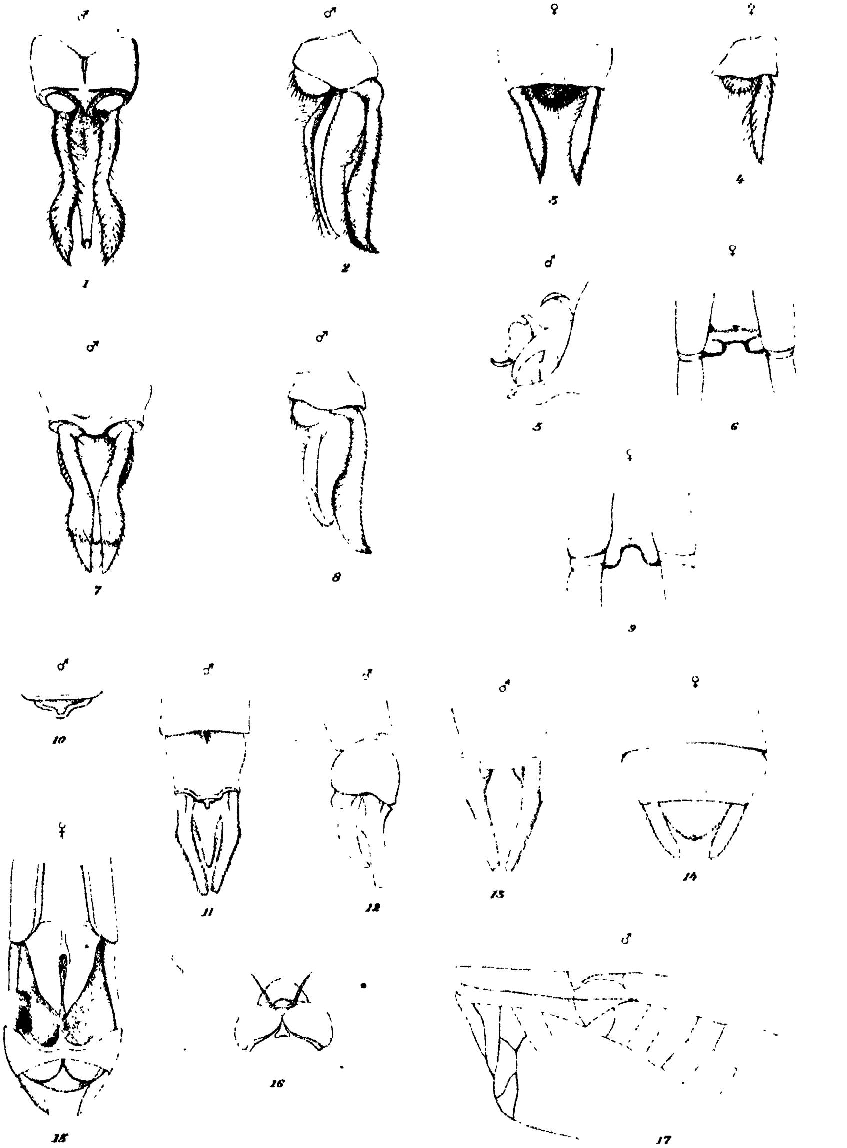
*Epitheca obsoleta* Say. (*polysticta* Burm.)

Fig. 7. ♂ Anal appendages. from above. (Burm.)
Fig. 8. ♂ Anal appendages, side view. (Burm.)
Fig. 9. ♀ Vulva, from below. (Say.)

*Cordulia lintneri* Hagen.

Fig. 10. ♂ Between anal appendages, from above.
Fig. 11. ♂ Anal appendages, from above.
Fig. 12. ♂ Anal appendages, side view.
Fig. 13. ♂ Superior anal appendages, from above.
Fig. 14. ♀ Anal appendages, from above.
Fig. 15. ♀ Vulva, from above.
Fig. 15. — Head, from above.
Fig. 17. ♂ Base of wing.

All the figures are drawn from the types.




H A Hagen del

B Meisel lith

HAGEN ON CORDULINA.

inflated; colors similar but the transversal yellow bands larger and on the 3d and 4th segments extended into a median dorsal line; last segment short, black, shining, with a flat basal impression; appendages as long as the segment, converging, cylindrical, rounded on tip, black, hairy; part between them large, black rounded. Vulvar lamina large, broad, a little shorter than the segment, split to the basal third, pointed, tapering gradually to the tip, yellow; cavity bordered by it black, with an elevated ridge, pointed in middle.

| | *Male* | *Female* |
|---|---|---|
| Length | 34 | 33 |
| Abdomen | 24 | 20-23 |
| Ala sup. | 22½ | 23 |
| Ala inf. | 22 | 21½-22½ |
| Pterostigma | 2 | — |
| Femur post. | 5 | 5 |
| Appendages | 1¾ | 1 |

| | *Male* | *Female* |
|---|---|---|
| Exp. ala | 47 | 48 |
| Lat. cap. | 6 | 5½ |
| Breadth ant. | 6 | |
| " post. | 7 | |

HABITAT: Center, N. Y.. Mr. J. A. Lintner, no. 2839, 27 May. 4♂; 2840, 21 May, 4♀. Two females (*L. vacua* Hagen, no descr.) from Saskatchewan, Lake Winnipeg, collected in 1860 by Robert Kennicott. The position of this rather eccentric, small species is near *C. ulheri*, but it is separated from that species by unusual characters. The anal angles of the hind wings of the male are nearly rounded; all triangles are without transversal veins; only one series of discoidal cells, and a very plain venation. It is very interesting that this apparently arctic species is found in eastern New York.

## DESCRIPTIONS OF SOME NEW NORTH AMERICAN DOLICHOPODIDAE.

BY WILLIAM M. WHEELER, MILWAUKEE, WIS.

(*Concluded from p. 362.*)

### PELOROPEODES, n. gen.

♂. Small dull metallic green species. Palpi prominent, though not enlarged. Antennae as long as the head and thorax; first joint stout, subcylindrical, glabrous on its upper surface, with a few hairs on its under side; second joint short, rounded, subcalyculate; third joint pubescent, very long, tapering from a broad rounded base to a blunt point, on which is inserted the thick, flexible arista. Face rather broad for a male, front ample. Thoracic dorsum moderately arched, beset with the usual stout setae; scutellum broad, short, smooth, with four setae. Abdomen with six segments, short, stout at the base but tapering very rapidly to the apex, where is attached the sessile and greatly enlarged hypopygium, consisting of a scuttle shaped box, two thirds the size of the abdomen, from the ventrad directed opening of which protude several hook-shaped chitinous appendages. Legs rather stout, hairy; tibiae equalling the femora in length; spurs of the fore tibiae short, those of the posterior pairs

of medium size; tarsi of all the feet somewhat longer than the tibiae; hind metatarsal joint without bristles. Wing somewhat longer than the body, slightly pointed; anal angle obtuse; fourth longitudinal vein slightly bent, entering the tip of the wing and scarcely inclined towards the end of the third longitudinal vein; second and third longitudinal veins straight, parallel; fifth longitudinal vein evenly curved, entering the posterior margin somewhat nearer the base than the apex of the wing; posterior cross vein perpendicular to the hind margin, distant about twice its length from the tip of the fifth longitudinal vein; sixth longitudinal vein short, distinct.

♀ of the same color as the male. Face rather broad, not attaining to the lower margin of the eyes. Antennae differing profoundly from those of the male; especially in respect of the third joint and its arista; the former being very short, semioval and flattened laterally, while the latter, inserted dorsally, and clothed with microscopic pubescence, is so long that if reflexed it would reach to the middle of the thoracic dorsum. Front ample; ocelli prominent. The rather large ovipositor, much exserted in all of my specimens, terminates in a comb-like organ with regular, short, blunt teeth.

(Generic name derived from πέλωρος, enormous, and πεώδης, provided with a large penis.)

PELOROPEODES SALAX, n. sp. ♂. ♀.

Length: ♂ 2.25 mm.; ♀ 2 mm.; length of wing ♂ 2.5 mm., ♀ 2.25 mm.

Dull metallic green. Palpi black. Face and front metallic green, almost obscured by whitish dust. Antennae black; pubescence of the elongated third joint of the male, whitish; bristles of the superior orbit black, those of the inferior orbit white. Thoracic dorsum dark metallic green, but so thickly covered with yellow dust, as to be subopaque in the male, opaque in the female; this dust is thickest on the anterior half of the thoracic dorsum; scutellum dusted with white with a metallic violet reflection; pleurae opaque, rather thickly covered with white dust. Cilia of the tegulae long, yellow. Metallic green ground color of the abdomen somewhat concealed by whitish dust; all the segments covered with sparse short black hairs; capsule of the hypopygium black, subopaque, with short appressed whitish pubescence on its lateral faces and a few short, irregularly placed setae in the median dorsal line; the numerous hook-like appendages pale yellow; ovipositor of the female yellowish red; teeth of its comb-shaped tip black. Fore coxae entirely yellow, beset towards their apices anteriorly with a few stout black hairs; posterior coxae with infuscated bases. Legs pale yellow, covered with rather stout black hairs, arranged in very regular rows on the tibiae; the posterior pairs have three spines on their posterior faces. Tarsi blackened from the tip of the first joint. Halteres yellow. Wings uniform grayish hyaline, somewhat pointed; base lanceolate; the portion of the fourth longitudinal vein beyond the posterior cross vein but very slightly bent, its end running parallel with that of the third longitudinal vein.

HABITAT: Milwaukee Co., Wis.

I have taken two males and three females of this species in a damp and rather dense wood where the undergrowth consisted very largely of *Boehmeria cylindrica* and *Impatiens fulva*.

CHRYSOTIMUS PUSIO, LOEW. ♂.

A number of females of this species captured on the foliage in damp woods near Milwaukee, agree with Loew's description except in the color of the antennae. According to Loew the antennae are "entirely black," whereas in all my specimens the two basal joints are honey yellow, while the third joint is

fuscous. The tergum of the last abdominal segment is also more blackish than metallic green. These differences are probably to be attributed to local variation. I subjoin a description of the male, which seems to have been unknown to Loew and which differs from the female in much the same manner as the male of the European *Chrysotimus molliculus*, Fallen, differs from its female.

Length: 1.5–1.75 mm.; length of wing 2.5 mm.

Bright golden green. Palpi blackish. Antennae with their two basal joints honey yellow; third joint fuscous, covered with distinct pale hairs. Cilia of the inferior orbit white; hairs and setae covering all other portions of the body honey yellow. The vivid metallic green of the thoracic dorsum and pleurae dimmed somewhat by a layer of whitish dust. Abdomen bright metallic green (venter yellowish?) of a shade differing from that of the thorax in being somewhat less golden and less subdued; hypopygium large and conspicuous; its outer portions brown, its inner appendages yellow. Legs honey yellow, the last tarsal joint on all the feet fuscous or black. Halteres yellow. Wings grayish hyaline. suffused with yellow, especially at their bases; veins honey yellow.

The six males before me were taken in company with the females of Loew's *C. pusio;* hence I believe there can be no doubt about their identity, especially since the relation that the sexes bear to each other is the same as that observed in the case of *C. molliculus.* My specimens have collapsed in drying so that I am unable to decide whether the venter is yellow, as in the European species.

APHANTOTIMUS, n. gen.

♂. ♀. Minute metallic green species, with rather thin integument, collapsing when dry; setae covering the body yellow; sexes alike in coloring. Palpi of moderate size. Antennae alike in both sexes; first joint short, smooth; second short and broader, provided with the usual hairs; third joint small, narrower than the second, spheroidal, with rather long, apically inserted and microscopically pubescent arista. Face rather broad in both sexes, narrowed below, not reaching to the lower corners of the eyes. Head situated rather deep on the thorax to which it seems to be closely applied. Thorax resembling in its shape the thorax of *Chrysotimus;* in the prescutellar region there is an extensive though shallow indentation, the exact shape of which my dried and collapsed specimens do not enable me to determine. Abdomen laterally compressed, in the male of six segments, tapering rapidly; hypopygium very large, pedunculate, distinctly flexed under the venter, capsule hood-shaped, with exserted appendages; a pair of these, apparently homologous with the lamellae of the hypopygium of *Dolichopus* and *Gymnopternus*, are disk-shaped and fringed with cilia; ovipositor large, usually exserted, resembling that of *Chrysotimus.* Legs rather smooth, with short and appressed spines; tibial spurs feebly developed; in the spinulation of the legs little or no sexual differences. Wings thin, hyaline, rather large; costa rather prominently arcuate; anal angle not very prominently projecting. Neuration resembling that of *Chrysotimus;* posterior cross vein more than twice its length distant from the border of the wing; fourth longitudinal vein gently bent beyond the posterior cross vein, and ending at or a little in front of the tip of the wing. With this vein the third longitudinal vein runs parallel and is in one species nearer to it than to the second longitudinal vein; second and third longitudinal veins presenting the same gentle curvature as the fourth.

(Generic name drived from ἄφαντος, forgotten, and τιμή, honor.)

The species of *Aphantotimus* resemble the *chrysotimi* in having yellow hairs and setae; in the prescutellar indentation, in the neuration of the wings and in the apical insertion of the antennal arista. The females, however, resemble the males in coloring, and do not have the abdomen largely yellow. The hypopygium of *Aphantotimus* is disengaged and very large, thus resembling that of the higher genera like *Dolichopus* and *Gymnopternus;* while the hypopygium in *Chrysotimus* is small and partly embedded. There are also differences in the size and shape of the third antennal joint; though this character is not of generic value.

The two minute species here described, differ considerably in the structure of the hypopygium, but to just what extent I have not ascertained, as this organ must be examined in recently killed specimens. Their close resemblance in other respects, e. g. in the structure of the antennae, neuration of the wings, shape of the body and covering of yellow hairs, leads me to unite them in the same genus.

APHANTOTIMUS WILLISTONI, n. sp. ♂. ♀.

Length 1.5–1.75 mm.; length of wing 1.5 mm.

Palpi pale yellow. Face metallic green, smooth; covered with a thin layer of yellowish dust, composed of minute scales that are clearly discernible, and not closely aggregated. Antennae entirely black, inclining to piceous or brown when viewed from their apices; third joint somewhat conical at the insertion of the arista and covered with scarsely perceptible pubescence. Front rather broad, blackish green, covered with the same dust as the face; frontal setae and those of the thorax and abdomen pale yellow; cilia of the inferior orbit yellow. Thoracic dorsum and scutellum golden green, overlaid with yellow dust, consisting of minute scales; pleurae bright golden green, less dim than the thoracic dorsum, growing black in the region of the tegulae. Cilia of the tegulae yellow. Abdomen bright metallic green, with a more violet than golden reflection; covered with short and stiff yellow hairs; in the female the exserted ovipositer is orange yellow; in the male the large hood-shaped hypopygial capsule is shining black, changing to metallic green in some lights; appendages pale yellow; the two lamellae rounded, fringed with yellow cilia; a long and exposed blade-shaped organ (the penis?) extends from the base to the tip of the hypopygium on the ventral side. Legs pale yellow; tips of the tarsi scarcely darker, covered with short brown hairs, which turn to yellow in some lights. In the male the fore coxae are fuscous anteriorly and basally; the posterior coxae are fuscous with yellow tips; in the female the coxae are largely pale yellow, there being only a large fuscous spot at their bases. Halteres large, yellowish white. Wings brownish hyaline with brownish veins; the third and fourth longitudinal veins parallel, and more approximated to each other than the third longitudinal vein is to the second.

HABITAT: Milwaukee Co., Wis.

The single male and three females in my collection were taken on the foliage in a swampy wood in company with hundreds of Dolichopods belonging to the genera *Dolichopus*, *Pelastoneurus*, *Sympycnus*, *Psilopus* and *Chrysotus*.

APHANTOTIMUS FRATERCULUS, n. sp. ♂. ♀.

Length 1–1.5 mm.; length of wing 1.25 mm.

Palpi brown, with white hairs. Face, front and occiput metallic green, covered with yellowish dust, the separate scales composing which are distinctly discernible as in the preceding species. Antennae black, resembling in structure those of *A. willistoni.* Cilia of the inferior orbit yellow. Thoracic dorsum bright metallic green with bluish reflection; the thin covering of dust and the comparatively few setae yellow; prescutellar depression very distinct, somewhat v-shaped; pleurae vivid metallic green, covered with a thin layer of yellow dust. Tegulae pale yellow, cilia yellow, changing to brown in some lights. Scutellum and abdomen vivid metallic green with violet and cupreous reflections, the rather long hairs on the latter pale yellow; venter and hypopygium black, the latter roughened, metallic green dorsally; appendages pale yellow. The capsule of the hypopygium is narrower and somewhat longer than in the preceding species; the long, blade-shaped appendage dark brown; the two lamellae dirty yellow with black tips, apparently without cilia on their edges. In the male, coxae and legs black, the former with yellow, the latter with black hairs. Femora with a faint metallic green luster; knees broadly yellow; trochanters, inner faces of the tibiae and bases of the separate tarsal joints dirty yellow. In the female the femora and tibiae are bright metallic green, the knees and trochanters yellow, the tarsi black. Halteres pale yellow. Wings faintly brownish hyaline; third and fourth longitudinal veins less approximated than in the preceding species; perfectly parallel and but very slightly curved from the posterior cross vein on. The fourth longitudinal vein terminates in the tip of the wing.

HABITAT: Milwaukee Co., Wis.

This species is very readily distinguished from *A. willistoni* by its smaller size, the more bluish and less golden reflection of its metallic surfaces, its dark-colored legs and the neuration of the wings. Three males and one female were taken with the preceding species.

XANTHOCHLORUS HELVINUS, LOEW. ♂.

Loew felt some doubt as to whether this species, which he described from female specimens only, was not merely a variety of the European *X. tenellus.* An examination of a number of males taken by me in several localities in the vicinity of Milwaukee, seems in no way to invalidate the species. In these specimens I can detect no green markings whatsoever. The general honey yellow color of the body is departed from only on the cheeks and front, which are has gray and on the pleurae, where I find two clearly defined black spots; one larger and more pronounced just back of the tegula and another smaller and more oval spot (not mentioned in Loew's description) on the metathorax just beneath the lateral edge of the scutellum. The powerful bristles on the head and thoracic dorsum, as well as the cilia of the tegulae and the hairs covering the other portions of the body are dark brown, almost black, thus contrasting with the yellow body color. The hypopygium is prominent, though hardly "dick angeschwollen" as is the case in the European *X. tenellus,* Wied, according to Schiner. The acute hypopygial appendages scarcely project and are honey yellow. The bases of the second, third and fourth abdominal segments are infuscated in dried specimens.

HYDROPHORUS PHILOMBRIUS, n. sp. ♂.

Length 3.5 mm.; length of wing 4 mm.

Dull olive green. Face bright metallic green, covered with white dust, which scarcely dims the brilliant ground color, except on the oral margin, where it is aggregated to form two spots, one on each side abutting on the orbit. Cheeks and palpi black, clothed with short appressed yellow pubescence; the pubescence on the eyes short and silvery white. Antennae black, pubescence on the third joint white, tip of the robust arista pale. Front and occiput of a blackish ground color, covered with glistening white dust which gives them a frosted appearance; cilia of the superior orbit black; those of the inferior orbit glistening white, but becoming tawny near the oral orifice. Thorax, scutellum and abdomen covered with the same frost-like dust as the front; as this dust, which consists of microscopic scales, is wanting about the insertion of each seta, the surface has a spotted appearance. The disk of the thoracic dorsum is crossed by four longitudinal shining purple bands, the outer pair being slightly broader than the inner; the spaces between these bands are vivid metallic green. Scutellum bearing four rather long black bristles; its median portion golden green, the lateral portions coppery red. Pleurae dull olive green, more olive brown towards the insertions of the coxae. Tegulae honey-yellow, with glistening white cilia. Abdomen olive green, in rear view more bluish; the rows of impressed dots along the tergal edges shining black; the sparse hairs covering the terga of the basal segments and the whole venter, glistening white; hypopygium black, concealed, appendages not apparent in my specimen. Legs and coxae covered with white dust; the fore pair of legs black; fore coxae dull metallic green, fore femora incrassated in the usual manner and bearing a few long spines at their bases on the under side; on the hind face of the distal two thirds of the fore tibiae there is an even comb of stout black spines; apical claw distinctly marked though not acute; the distal half of the fore tibiae and black tarsi with short and dense white pubescence. Posterior femora and tibiae slender, vivid metallic green; posterior tarsi with white pubescence somewhat more scattered than on the fore tarsi. Pulvilli and empodia of all the feet white, fringed with silvery hairs. Halteres bright honey yellow, the base of the peduncle somewhat infuscated. Wings long and narrow, costal and posterior margins parallel, uniformly grayish hyaline; veins black, becoming yellow near the insertion of the wings; third and fourth longitudinal veins gently approximating near the tip of the wing, but again diverging slightly at their juncture with the costa; sixth longitudinal vein very short and incomplete.

HABITAT: Milwaukee Co., Wis.

This large and beautiful species seems to be related to the Alaskan *Hydrophorus innotatus*, Loew. It may be distinguished by the white dust on the face and front, the glistening white cilia of the inferior orbit, the vittate thoracic dorsum, the bright yellow halteres and the yellow bases of the nervures of the wing.

It is possible that the species which I here call *H. philombrius* is one of the two species mentioned by Baron v. Osten Sacken (Western Diptera p. 320.) "One from Webber Lake, Sierra Nevada (July 25) is allied to *H. innotatus*, Loew from Sitka (Monogr. 2 p. 212) in the coloring of the face, the upper part of which is greenish, and in other characters; its halteres, however, have a yellow, and not an infuscated knob. The other species, taken near Santa Barbara (January 25), is easily distinguished by the

color of its first longitudinal vein, which is brownish yellow; the costa beyond the insertion of the first vein is of the same color."

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## Entomological Notes.

Prof. F. H. Snow has been elected chancellor of the Kansas State University at Lawrence. Princeton College at commencement last June conferred the degree of LL. D. upon Chancellor Snow.

JUNONIA COENIA.—In a letter to Mr. S. H. Scudder, Mr. Justus W. Folsom writes "On 30 July 1890 I saw an unmistakable specimen in Cambridge, Mass., on flowers of *Nepeta cataria* bordering the Charles river. The insect was apparently in perfect condition."

Mr. C. J. Maynard's work on the butterflies of North America will make an octavo volume of about 200 pages, illustrated with many wood-cuts. The descriptions are short and comparative. De Wolfe, Fiske & Co. of Boston are the publishers.

Mr. H. T. Fernald, a son of Prof. C. H. Fernald, of the Massachusetts Agricultural College, has completed a post graduate course in biology at the Johns Hopkins University, receiving the degree of Ph. D., and has been elected professor of zoölogy in the Pennsylvania state college. The Johns Hopkins University Circular (No. 80 April 1890) contains his "Studies in thysanuran anatomy," a preliminary communication.

BRITISH ORTHOPTERA. The July issue of the Entomologist's monthly magazine contains the conclusion of Mr. Eland Shaw's "Synopsis of British orthoptera." The list of species includes,

6 Forficulidae,
7 Blattidae,
14 Acrididae,
10 Locustidae and
5 Gryllidae, a total of 42 species. of which 3, *Anisolabis maritima*, *Phaneroptera falcata* and *Oecanthus pellucens* are included with some doubt. The synopsis was commenced in the number for August 1889, and altogether fills a little over 50 pages.

NEUROPTERA OF IRELAND. In his catalogue of the neuroptera of Ireland (Proc. & Trans. nat. hist. soc. Glasgow, 1890, n. s. v. 2, p. 259-292) Mr. James J. F. X. King gives the following comparative summary of the genera and species of neuroptera occurring in Ireland, Great Britain and Belgium.

| | Ireland. | | Great Britain. | | Belgium. | |
|---|---|---|---|---|---|---|
| | Genera. | Species. | Genera. | Species. | Genera. | Species. |
| Psocidae | 7 | 26 | 10 | 38 | 7 | 22 |
| Perlidae | 6 | 11 | 9 | 24 | 8 | 21 |
| Ephemeridae | 11 | 23 | 13 | 37 | 16 | 28 |
| Odonata | 15 | 25 | 22 | 45 | 24 | 64 |
| Planipennia | 6 | 23 | 14 | 51 | 15 | 56 |
| Trichoptera | 28 | 103 | 61 | 155 | 57 | 136 |
| Total | 73 | 211 | 129 | 350 | 127 | 327 |

TERMITES INJURIOUS TO GROWING TREES. —Mr. Henry Tryon mentions (Queensland Department of agriculture, Report on insect and fungus pests, No. 1, p. 228-229) that complaints concerning injuries to growing trees by termites are common in the western and northern parts of the colony. The termites find their way into the tree through some accidental opening or weak spot; frequently they start at the collar of the tree or just at the surface of the ground and thence work upwards.

Mr. Tryon does not identify the species; he states that all kinds of shade and fruit trees are attacked except those belonging to the orange family. In Florida termites frequently injure orange trees though old and well established trees are little liable to their attacks.

**Food-plant of Carpocapsa saltitans.** —The food-plant of this tortricid, the larva of which is the cause of the so-called "Mexican Jumping seeds," has been a matter of considerable doubt. At a meeting of the natural history society of Glasgow, held 26 March 1889 (Proc. & trans., 1889, n. s. v. 3, p. 26 Proc.) Mr. A. Somerville showed specimens of *Carpocapsa saltitans* Westw., bred from the seed vessels of *Colliguaja odorifera*. This plant, one of the euphorbiaceae, is a native of Chili, and was first described by Molina (History of Chili, English ed., v. 1, p. 291). Hooker (Bot. misc., 1830, v. 1, p. 142, pl. 40) also describes and figures the species and mentions that plants introduced into greenhouses in Scotland thrive well. In Chilian Colliguaja it is called "pichroa" and from early times has been used medicinally. The moth was originally described by Westwood (Proc. Ashmolean soc. Oxford, 1857, v. 3, p. 137-138: Trans. ent. soc. London, n. s., v. 5, p. 27, Proc. for 7 June 1858) from specimens bred from seed received from Tassic, Mexico (cf. Trans. ent. soc. London, n. s., v. 4, p. 90, Proc. for 5 October 1857 and op. cit., n. s., v. 5, p. 8, Proc. for 1 March 1858. See also Gardener's chronicle 12 November 1859, p. 909). Westwood gives the habitat as "Larva in seminibus plantae Peruvianae Calliguaja dictae, quae motu saltatorio mire progrediuntur." Subsequently the species was described by Lucas as *Carpocapsa dehaisiana* (see Ann. soc. ent. France, 1858, s. 3, v. 6, p. 10. 33, 41-44, Bull; ibid, 1859, s. 3, v. 7, p. 561-566: C. R. acad. sci. April 1858, v. 46, p. 685-689: Rev. et. mag. zool., April 1858, v. 10, p. 171-177: ibid, November 1858, p. 470-484, pl. 16: L'Institut, 1858, v. 26, p. 127-128).

Riley (Trans. acad. sci. St. Louis, 1876, v. 3, p. 190-191, Proc.) mentions, on the authority of Mr. G. W. Barnes of San Diego, Cal., that the plant is called Yerba de flecha and Colliguaja by the Mexicans, and in the Proc. U. S. nat. mus., 1883, v. 5, p. 632-635 states also on the authority of Mr. Barnes "that the region of Mamos in Sonora is the only place where the plant grows."

**Revision of the Mantidae.** Prof. J. O. Westwood's recently issued work on the mantidae entitled "Revisio insectorum familiae Mantidarum, specibus novis aut minus cognitis descriptis et delineatis" consists of a synonymical and bibliographical list of the species, an appendix with descriptions of six new genera and one hundred and eight new or little known species, a bibliography of the family, an alphabetical index of the genera, species and synomyms, a page of corrections and additions and three pages explanatory of the fourteen lithographic plates. One hundred and eight species are figured. In the list Prof. Westwood recognizes sixteen groups, 154 genera and 645 species. There are however some duplications in the list and a few additional names are given in the addenda. The Palaearctic region has twenty-two genera and sixty-seven species; five of the genera are strictly confined to this region. The Nearctic region is especially poor in species, there being but ten in the list and of these *Stagomantis dimidiata* is a dimorphic form of *S. carolina*. Of the six genera none are peculiar to the region. The species are,

102. Gonastista grisea Fabr. N. Amer.
123. Oligonyx uhleri Stal. La.
125. scudderi Sauss. Geo?
128. graminis Scudd. Fla.
132. Thesprotia baculina Bates. St. Johns' Bluff, E. Fla.
163. Mantis wheeleri Thomas. Colorado.
355. Stagomantis carolina Linn. N. Amer. Ill. Car. Mex.
356. dimidiata Burm. Amer. Pa. to Buenos Ayres.
359. minor Scudd. Neb.
607. Pseudovates chlorophaea Blanch. U. S.

The Neotropical region is very rich in species, about 175 being listed. There are twenty-nine genera exclusively confined to this region. The Australian region with 64 species has but six peculiar genera. The Oriental region has 165 species and thirty genera not found in any other region and the Ethiopian region with 168 species has the largest number of peculiar genera, namely thirty-two.

# PSYCHE.

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 172–174.**

August—October, 1890.

*CONTENTS:*



Published by the

CAMBRIDGE ENTOMOLOGICAL CLUB,

Cambridge, Mass., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

[Entered as second class mail matter.]

PSYCHE.

# NOTES AND DESCRIPTIONS OF SOME NORTH AMERICAN LIBELLULINA.

SYNOPSIS OF NEUROPTERA, SECOND EDITION.

BY HERMANN AUGUST HAGEN, CAMBRIDGE, MASS.

1. CELITHEMIS EPONINA Drury.

I first established *Celithemis* for this species which is found everywhere in the United States, east of the Rocky Mountains from Minnesota to Florida and Texas; it also occurs in Cuba. It is rather variable in the spots of the wings.

2. CELITHEMIS FASCIATA Kirby.

Kirby, Trans. zool. soc. London, 1889, v. 12, p. 326, pl. 52, f. 2. Two males, one immature from Georgia. In the exhibition of Canadian insects (1886) in London, England, a young male said to be from Toronto, Ontario, was labelled by myself *C. anna* (no description), after two males from Enterprise, Fla. The female is unknown to me. I believe this species is near to *C. eponina* of which I have before me a large number from Enterprise. The discovery of the female is still needed.

3. CELITHEMIS ELISA Hagen.

I have placed this species in my Synopsis (1861, p. 182) in *Diplax* followed by *D. ornata* and *D. amanda*, of which I had then before me very insufficient material. Walsh directly referred *D. elisa* to *Celithemis* and Kirby (l. c., p. 275) proposed the same for *D. ornata* and *D. amanda*. I have now before me a large material ranging from Canada to Georgia. The species is very remarkable in having the tips of all the wings blackish as in *C. fasciata;* all the other spots are more or less variable.

4. CELITHEMIS BALTEATA Hagen.

I have described the young female from western Texas in my Synopsis (1861, p. 140) among *Tetragoneuria* with the remark, "Does it belong to this genus?" Later I sent this female and the only male from Cuba (Poey) to DeSelys and he answered "a Libellula but difficult a placer." I have since received both sexes and fully colored specimens from Key West, Fla. There is no doubt but that the species belongs here and stands, though a little larger, between *C. elisa* and *C. ornata*. By a curious chance this species is omitted from my Synopsis of 1875. A new and full description is needed.

5. Celithemis ornata Ramb.

Instead of two specimens mentioned in my Synopsis (1861, p. 182) I have a large number from the eastern parts of the United States and I have been told by Mr. Calvert that it has been collected in Maine.

6. Celithemis amanda Hagen.

I have in my Synopsis (1861, p. 183) described this species after the type (♀) of Burmeister from Georgia (his *Libellula pulchella*, a name used long before) as the next to *D. ornata*, having only two series of discoidal areolets. I have now before me a larger material, some collected with *D. ornata* and I think it very probable that both forms may be the same species and perhaps may be found in South America also.

The other species *C. superba* given in my Synopsis, (1861, p. 148) of which I had then only a female is now referred to a separate genus, *Pseudoleon* Kirby. There are believed to exist four species, of which I can not now give an opinion. I believe that it is very near to *Celithemis.*

7. Libellula incesta Hagen.

Teneral male, Front yellowish, superiorly darker with a black transversal band before the eyes; labrum yellow, margin black; labium paler, the outer and inner margin finely black; vertex brown, paler in the middle; occiput brown; eyes black behind two yellow spots on the inferior half of the border; prothorax brown, two spots in the middle and the posterior lobe yellowish white. Thorax brown with a yellowish white band extending between the wings to the abdomen; sides yellowish white with an inferior blackish band above the legs, formed by four triangular spots; suture between meso- and metathorax with a superior blackish line; thorax beneath whitish, the black spots extending down between and behind the legs. Abdomen blackish brown with a broad yellowish band each side, paler and larger on segments 2–3, united on 1 and on the base of 2; very near to the outer border of the segment, which is finely black, on segments 3–9; segment 10 yellow with two black spots in the middle; abdomen beneath yellow, margin of the segments finely bordered with black; venter brown; appendages black, the inferior brown in the middle. Legs black, pale at the base, anterior femora pale brown above nearly to tip. Antecubitals 15–18 (12–13 ala inf.); postcubitals 11–13; $3\frac{1}{2}$–4 areolets beneath pterostigma; 3 discoidal areolets; after the triangle sometimes 4; 1-2 transversals in the triangle. Length 53 mm.; abdomen 36 mm; ala sup. 41 mm.; ala inf. 83 mm.; pterostigma $5\frac{1}{2}$ mm.; appendages $2\frac{1}{2}$ mm.; cap. 8.

Habitat: Two males, Milton, Massachusetts July 1873 H. K. Morrison.

There are no differences between *L. incesta* and *L. lydia* except that the basal line and nodal point are fuscous black in the latter; *L. incesta* is generally smaller; the pterostigma is shorter. When I described *L. incesta* (Synopsis, 1861, p. 155) I had before me only two very old males from Carolina. Now

I have a dozen of both sexes young and adult from Canada to Florida. With an equally large material of *L. lydia* and of *L. axillena* it seems to be certain that all belong to the same species.

8. DIPLAX RUBICUNDULA Say.

*Libellula rubicundula* Say, Journ. acad. nat. sci. Philad. 1839, ser. 1, v. 8, 26, 14.

*Diplax rubicundula* Hagen, Syn. Neur. N. A. 1861, 176, 6—Proc. Bost. soc. nat. hist. 1873, v, 15, 267, 17; 377, 10; 1875, v, 18, 73, 3 — Scudd. ibid, 1866, v, 10, 219.

Rufescent front and mouth parts yellowish; a narrow black band before the eyes between vertex and front; vertex brown, paler on tip, villous; eyes rufescent in life, behind olivaceous with two transversal darker marks; antennae black; prothorax rufous, hind border with two large rounded lobes, densely ciliated on border, thorax rufous, (♂) greenish brown (♀), sides same color more yellowish beneath; legs black, anterior femora sometimes the intermediate and posterior, luteous beneath at the base; abdomen long, slender, saguineous (adult male), or yellowish with a maculose lateral black stripe, except at the base (♀); appendages, rufescent; superior ones of the male longer, apical half recurved, apex acute, beneath upon the middle with a stouter tooth, denticulated anteriorly; inferior appendage shorter, triangular, exceeding somewhat the tooth of the superior ones, the apex a little excised; the genital hamulus rather long, very bifid, the external branch broader, triangular; the internal one a little longer, narrow, subincurved; the genital lobe short, triangular; the apex narrow; anterior plate widely notched on the tip; penis with two shorter pale apical setae; appendages of female cylindrical, pointed; vulvar lamina small, triangular, the base inflated, bifid by a channel. to the base, forming two conical pointed, recurved lobes; concave inside; wings hyaline, the extreme base yellowish; pterostigma quadrangular, fuscous, at both sides paler; membranule white; antecubitals 7 (8); postcubitals 7 (7-9); 3 discoidal areolets.

Length 32-37 mm; alar expanse 50-58 mm.; pterostigma 2 mm.

HABITAT: Massachusetts summer to very late fall; New Hampshire, August, September; Maine: New York; New Jersey; Pennsylvania; Maryland; Washington, D. C.; Indiana (Say); Illinois; Lake Superior; British America;

9. DIPLAX MADIDA Hagen.

*Diplax madida* Hagen Syn. Neur. N. A. 1861, 174,2—Proc. Bost. soc. nat. hist. 1875, v. 18, 80, 11.

Rusty brown, subvillous; front and mouth parts, paler, reddish, vertex, inflated, reddish, tip truncated a little notched; occiput pale brown, villous behind; antennae black; eyes behind yellowish, with three dark brown transversal bands; prothorax darker above; the hind border with two paler large rounded lobes, densely ciliated on the border; thorax dark rusty brown

with brown hairs, lateral sutures near the wings blackish; thorax of the female sometimes of a paler shade on the sides above and before the legs; legs black, trochanters red; anterior femora of the female pale on the basal half below; abdomen reddish. of the female sometimes paler, with the base of the 1st and 2nd segments, the dorsal suture about the 8th and 9th segments, and a lateral stripe in some segments blackish; most of the females with the abdomen reddish without any marks; appendages of the male as long as the penultimate segment, reddish, cylindrical, straight, the pointed tips subdivergent; viewed laterally truncated obliquely at the tip, below with a series of about seven small black teeth in a line before the apex, which is bent upwards, notched with two apical small teeth above; the genital hamulus dark yellowish, forming an elongated plate, concave internally, rounded at the tip; interiorly before the tip, a small but strong black bent hook, penis dark, with two long curved apical setae; anterior plate deeply split, black, bilobate; genital lobe short, narrow, contracted before the rounded tip; appendages of the female shorter than the penultimate segment, pale reddish, cylindrical, pointed; between them a large reddish conical lobe; vulvar lamina yellowish, short, with an angular excision, forming two triangular lobes with a somewhat blunt tip, concave inside.

Wings fumose, the anterior margin and the base more in the hind wings extending beyond the base, flavescent; veins brown; pterostigma long, narrow reddish; in the females more yellowish, at least below; membranule white; antecubitals 8 (6-9); postcubitals 8 (6-9); 3 discoidal areolets. Length 38-41 mm.; alar exp. 58-64 mm.; pterostigma 3 mm.

HABITAT: Montana 8 August. Three Buttes near head of Milk River; Upper Missouri, Yellowstone (Konopicky); Gulf of Georgia, California, (A. Agassiz); Victoria, Vancouver Island, July (Crotch, H. Edwards); California (H. Edwards.)

This species was described in my Synopsis from the rudiment of a female preserved for a long time in alcohol; thus the paler colors are explained: I have seen 15 specimens male and female.

10. DIPLAX FLAVICOSTA Hagen.

*Diplax flavicosta* Hagen, Proc. Bost. soc. nat. hist. 1875, v. 18, 81, 13.

A pair caught in copula at San Diego, California by Mr. Crotch induced me to separate them as species. The size and external appearance is similar to *D. madida*. The wings are hyaline, with the anterior margin to the mediana and a small space at the base of the hind wings flavescent. The male is similar to *D. madida* but the superior appendages have about a dozen small teeth on a line beneath the apical half. The female has on each side of the thorax an oblique pale band, better defined and broader near the legs; on each side along the abdomen a black band is indicated and is more developed at the apex of the segments; the dorsal median

edge is blackish on the 8th and 9th segments, the vulvar lamina with the lobes more pointed on the tip, and better separated at the base.

If *D. flavicosta*, as I believe, is merely a variety of *D. madida*, four smaller females from Victoria, Vancouver Island, July, can not be separated. The smallest is 31 mm. in length; alar expanse 50mm.; pterostigma 2 mm. The wings are fumose, the anterior margin flavescent in one, another has the base to the nodus or only beyond the triangle flavescent; the anterior pale band on the sides of the thorax is plainly visible; a large black band on each side of the abdomen is complete; in one female the black extends from the end of the segments to the middle ridge.

## SYNONYMY OF THE HOMOPTERA DESCRIBED BY SAY, HARRIS AND FITCH.

BY E. P. VAN DUZEE, BUFFALO, N. Y.

In the *homoptera* as in other branches of our favorite science a solid foundation was laid by that illustrious pioneer of American entomology, Thomas Say, whose brief but concise descriptions of many of our native insects have elicited universal commendation from later students. Scarcely inferior to that of Say is the work done many years later by Asa Fitch most of whose numerous species may be readily recognized from his short, clear diagnoses. Intermediate in point of time comes the work of Thaddeus William Harris to whom, however, we owe the description of but very few homopterous insects. In the present paper I propose to give the corrected nomenclature of the *homoptera cicadinae* described by these honored leaders of American entomology so far as it is known to myself or has been made known by recent writers.

Many of these names have been in common use for years, but a number are to be found only in rare or little known papers, and not a few are now for the first time systematically placed. In a few cases where I still feel in doubt the reference is followed by a question point.

Of the 71 species described by Say 60 are known to me; all of those described by Harris, 6 in number, and all but 15 of the 74 species described by Fitch. Two of those described by Say, viz., *Jassus sanctus* and *Membracis subulata*, are, so far as I can learn, unknown to our later entomologists. In the *cicadidae* and *typhlocybidae* I have quoted all references from the studies of Messrs. Uhler and Woodworth whose valuable synonymical notes on these families may be found in Ent. Amer. v. 4, 21 and 81, and PSYCHE,

v. 5, p. 67 and 211. In these cases as in others where I have not personally studied the insect I have appended my authority for the name employed. To species still unknown to me in nature I have prefixed an asterisk.

The following species require no change of name to bring them into correspondence with our modern nomenclature.

DESCRIBED BY SAY:

Cicada dorsata.
* " marginata.
* " vitripennis.
Aphrophora 4-notata.
Tettigonia bifida.
" hieroglyphica.

DESCRIBED BY FITCH:

* Anotia burnetii.
* " robertsonii.
* " westwoodi.
Bruchomorpha dorsata.
Ceresa brevicornis.
" taurina.
* Cicada superba (auct. Woodworth).
* Cixius cinctifrons (auct. Ashmead).
* Cixius coloepium (auct. Ashmead).
Cixius pini.
Clastoptera proteus.
* " pini (auct. Ashmead).
* Clastoptera testacea (auct. Ashmead).
* Cyrtosia fenestrata (auct. Uhler).
Eucanthus orbitalis.
Gypona flavilineata.
" scarlatina.
Helochara communis.
Idiocerus alternatus?
" lachrymalis.
" maculipennis.
" pallidus.
" suturalis.
* Naso robertsoni (auct. Uhler).
Otiocerus amyoti.
* " kirbyi.
" signoreti.
Pediopsis trimaculata.
" viridis.
Penthimia americana.
Telamona concava.
" coryli.
" fasciata.
" reclivata.
Tettigonia tripunctata.
Thelia crataegi.

Some of them will doubtless prove on further study to be but varieties of other forms and a few may yet have to be placed as synonyms of earlier described species.

The following names required to be changed.

DESCRIBED BY SAY:

Aphrophora bilineata = Philaenus lineatus Linn.
Cercopis bicincta = Monecphora id.
Cercopis obtusa = Clastopera id.
Cercopis parallela = Aphrophora id.
Cercopis 4-angularis = Lepyronia id.
* Cicada aurifera = Cicada marginata Say (auct. Woodworth).
Cicada hieroglyphica = Tettigea id, (auct. Uhler).
Cicada parvula = Carineta id. (auct. Uhler).
Cicada pruinosa = Cicada tibicen

Linn. (auct. Woodworth), probably a variety.*

Cicada rimosa = Tibicen id. (auct. Woodworth).

Cicada synodica = Tibicen id. (auct. Woodworth).

Delphax tricarinata.

No genus yet established seems properly to include this species.

Flata bivittata = Amphiscepa id.

Flata bullata = Thionea id.

* Flata conica.

This name is not changed by Mr. Ashmead. (See Smith's Cat. Ins. of New Jersey, p. 438.)

Flata humilis = Oliarus id.

Flata nava = Phypia (?) id.

* Flata opaca = Helicoptera id. (auct. Uhler).

Flata pallida = Helicoptera id.

Flata pruinosa = Ormenis id.

Flata 5-lineata = Oliaris id.

Flata stigmata = Cixius id.

Fulgora sulcipes = Scolops id.

Jassus acutus = Platymetopius id.

Jassus clitellarius = Thamnotettix id.

Jassus immistus = Scaphoideus id.

Jassus inimicus = Deltocephalus id.

Jassus irroratus = Phlepsius id.

Jassus novellus = Agallia id.

Jassus olitorius = Jassus (as restricted by Stål) id.

Jassus seminudus = Athysanus id.

Jassus subbifasciatus = Jassus olitorius Say ♀.

* Jassus verticis.

Mr. Uhler places this as congeneric with *Idiocerus pallidus* Fh. and *ramentosus* Uh. Possibly it will prove identical with *Idiocerus alternatus* Fh. which name it would then supercede.

Membracis arquata.

This is congeneric with an undescribed form placed by Mr. Uhler in *Ophiderma* Fairm., but the transverse apical cell of the elytra will perhaps entitle them to generic distinction.

Membracis belligera = Platycotis id.

Membracis binotata = Enchenopa id.

Membracis calva = Acutalis id.

Membracis concava = Publilia id.

Membracis diceros = Ceresa id.

Membracis festina = Stictocephala id.

*Membracis goniphora = Stictocephala inermis Fab.

Membracis inornata = Atymna id.

Membracis latipes = Campylenchia curvata Fab.

Membracis marmorata = Carynota id.

Membracis mera = Carynota id.

Membracis 4-vittata = Platycotis id.

Membracis semicrema = Acutalis id.

* Membracis tartarea = Acutalis id. (auct. Uhler).

Membracis trilineata = Cyrtosia id.

This may prove to be a synonym of *C. mutica* Fab.

Membracis vau = Cyrtosia id.

Tettigonia basilaris = Typhlocyba id. (auct. Woodw.)

* Tettigonia coagulata = Homalodisca id. (auct. Stål).

Tettigonia comes = Typhlocyba id. (auct. Woodw.)

Tettigonia limbata = Oncometopia id.

Tettigonia mixta = Acocephalus id.
Tettigonia mollipes = Diedrocephala id.
Tettigonia obliqua = Typhlocyba id. (auct. Woodw.)
* Tettigonia occatoria.
Dr. Stål does not change this combined name in his HEMIP. MEXICANA.
Tettigonia octolineata = Gypona id.
Tettigonia 4-vittata = Diedrocephala coccinea Forst.
Tettigonia trifasciata = Typhlocyba id. (auct. Woodw.)
* Tettigonia versuta = Diedrocephala id. (auct. Woodw.)

DESCRIBED BY FITCH:

Acocephalus vitellinus=Selenocephalus id (auct. Ashmead).
Amblycephalus curtisii = Athysanus id.
Amblycephalus melsheimeri = Deltocephalus id.
Amblycephalus sayi = Deltocephalus id.
*Aphrophora signoreti.
Doubtless correct.
Athysanus abietis=Bythoscopus variabilis Fh. ♂.
*Athysanus fagi.
Certainly a species of *Bythoscopus*.
Athysanus fenestratus=Bythoscopus id.
Athysanus minor=Bythoscopus id.
Athysanus nigrinasi = Bythoscopus id.
Athysanus variabilis = Bythoscopus id.
Aulacizes novaeboracensis=Diedrocephala id.

Bythoscopus strobi=Phlepsius id.
Bythoscopus tèrgatus=Grypotes id. (auct. Uhler).
Bythoscopus unicolor=Grypotes id. (auct. Uhler).
Cicada robertsoni = Cicada dorsata Say. (auct. Woodw.)
Cixius impunctatus=Myndus id.
Delphax arvensis=Liburnia id.
Delphax dorsalis = Stenocranus id.
*Empoa coccinea = Typhlocyba id. (auct. Woodw.)
Empoa querci = Typhlocyba id. (auct. Woodw.)
Erythroneura affinis=Typhlocyba id. (auct. Woodw.)
Erythroneura tricincta=Typhlocyba id. (auct. Woodw.)
Erythroneura vitifex=Typhlocyba id. (auct. Woodw.)
Erythroneura vulnerata=Typhlocyba id. (auct. Woodw.)
Jassus fulvidorsum=Phlepsius id.
Lepyronia saratogensis=Aphrophora id.
*Monecphora ignipecta=var. of Monecphora bicincta Say.
Poeciloptera vulgaris=Lamenia id.
Smilia auriculata=Archasia galeata Fab.
Smilea castaneae =Atymna inornata Say ♂ (?).
(See under *Telamona unicolor*)
Smilia querci=Atymna id.
Telamona fagi = Heliria scalaris Fairm.
Telamona querci=Telamona monticola Fab.
Telamona tristis = Telamona coryli Fh. ♀.

These forms I have taken *in coitu*. I have never met with a ♂ *tristis* nor a ♀ *coryli*.

Telamona unicolor=Telamona fasciata Fitch. ♀ (?).

These forms always occur together and of the large number I have examined the former are always females and the latter males. On the strength of this I have placed them as a single species and am confident that future observations will justify me in so doing. The case is the same with *Smilia castaneae* Fitch. and *Membracis inornata* Say.[1]

Tragopa dorsalis=Acutalis id.

Uroxiphus caryæ=Microcentrus id.

DESCRIBED BY HARRIS:

Cicada canicularis=var. of Cicada tibicen Linn. (auct. Woodw.)

Membracis ampelopsidis=Telamona id.

Membracis univittata=Thelia id.

Tettigonia vitis = Typhlocyba id. (auct. Woodw.)

Tettigonia rosæ = Typhlocyba id. (auct. Woodw.)

Tettigonia fabæ = Typhlocyba id. (auct. Woodw.)

The *Centrotus acuminatus* of Fabricius has been placed by Say, Harris and others as the ♀ of his *Membracis bimaculata*. I have however both sexes of both of these species; the females scarcely differ from the males in form. Our described species of this genus are .

Thelia bimaculata Fab.
uhleri Stål.
*turriculata Emmons.
crataegi Fitch.
univittata Harr.
acuminata Fab.

*Carynota* Fitch. Dr. Stål is mistaken in placing this genus as a synonym of *Ophiderma* Fairm. It is quite widely separated from that genus but is very near his *Optilete* of which *Thelia porphyrea* Fairm., a species unknown to me, is the type. It is possible that Stål was unacquainted with the *Membracis mera* Say, which is properly the type of Fitch's genus, and hence was deceived by Dr. Fitch's erroneous reference of *Membracis arquata* Say to his *Carynota*.

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[1] The following is the correct synonymy of this genus so far as I can make out:

Telamona reclivata Fitch.
monticola Fab.
querci Fitch.
ampelopsidis Harr.
*cissi* Harr. (List.)
*cyrtops* Fairm.
concava Fitch.
*ornata* Emmons.
coryli Fitch ♂.
*tristis* Fitch ♀.
fasciata Fitch ♂.
*unicolor* Fitch ♀.
*mexicana Stål.
*excelsa Fairm.
*pyramidata Uhler.

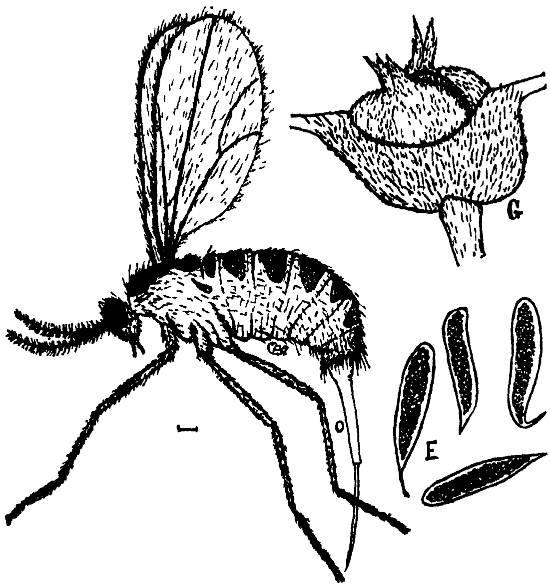
# A NEW CECIDOMYIID INFESTING BOX-ELDER (*Negundo aceroides*).[1]

BY C. P. GILLETTE, AMES, IOWA.

CECIDOMYIA NEGUNDINIS n. sp.

*Galls.* — The galls (G) are produced from terminal buds on all parts of the tree. Each is made up of a number of transformed leaves and petioles arranged in pairs in which the two leaves are opposite. They are subglobular in outline and vary from less than one half of an inch to nearly an inch in diameter. The outer basal portion of the gall is formed by an enormous enlargement of the bases of the petioles of two leaves which unite and form a receptacle like the cup of an acorn holding the inner portions of the gall. In the central part of the gall, the leaf blades may be entirely involved or their tips may be partially expanded.

*Gall-flies.*—Females, dry specimens. *Eyes* large, coal black and coarsely granulated; *antennae* one-half the length of the insect, 13-jointed, first joint globular, remaining joints cylindrical, second and third joints contracted in the middle, pedicels of joints short, about one-quarter the length of the joints, all of the joints moderately set with hairs the longest of which nearly equals the joints in length. *Thorax* very dark brown, opaque, and naked except two rows of long gray hairs in longitudinal grooves running from collar to scutellum and similar hairs at the sides of the thorax; scutellum of the same color as the mesothorax and with a few long gray hairs. Beneath the wings it is yellowish. *Dorsum* dark brown, sides of *abdomen* and venter light yellow; abdomen sparsely set with gray hairs above and below. *Ovipositor* yellowish brown and in specimens taken while ovipositing, it is exserted one




*CECIDOMYIA NEGUNDINIS* n. sp.
Adult female, O, avipositor, E, eggs, G, gall. Fly and eggs greatly enlarged. gall slightly enlarged. *Original.*

[1] Read before the Iowa academy of science, 5 September 1890.

and one-half times the length of the insect. *Legs* rather pale, tibiae and tarsi infuscate, rather densely set with silvery hairs. *Wings* beautifully iridescent and rather sparsely set with long gray pubescence, fringed all the way around; costal and first longitudinal nervures rather heavy and united at the apex of the wing as one continuous vein. The little cross vein between the first and second transverse nervures and the outer or upper branch of the fork in the third transverse nervure are almost obsolete and scarcely visible except in favorable light. Length of dry specimens one and one-half mm. Length of fresh specimens two mm.

The eggs (E) are a bright orange color, .4 mm. in length and much elongate. Some are straight, others are variously bent and all are pointed at one end and often with a short pedicel attached.

This insect is decidedly an injurious species. Trees upon the College campus that were the most severely attacked by this fly the past summer have had not more than half of their normal amount of foliage this year.

On the 18th of April, last, the writer noticed the flies abundant among the branches of the trees and the process of egg-laying was carefully watched with a hand lens. The females were so intent in their duties for the propagation of the species that they were not easily disturbed. They do not pierce the bud scales but work their long slender ovipositors far down between the scales and there deposit a large nest of eggs, sometimes forty or more in a place. By separating the scales the clusters of eggs can be plainly seen with the naked eye. The irritation set up by these eggs and the maggots that hatch from them aided, perhaps, by a poisonous secretion from the mother insect causes the abnormal development of the part. The galls all die a few weeks later when the maggots leave them. These dead galls turn black and remain upon the trees giving them an unsightly appearance.

## PREPARATORY STAGES OF CERURA MULTISCRIPTA, RILEY.

BY HARRISON G. DYAR, RHINEBECK, N. Y.

*Egg.* Slightly more than hemispherical, the base flat, dead sordid white, covered with many short dark brown hairs irregularly laid on and distributed also on the parts of the leaf adjoining. Diameter 1.3 mm. Laid in groups of five or less on the under surface of a leaf. These eggs had hatched when found, the larva having emerged from a hole in the side, leaving the rest of the shell intact.

*First stage.* Head subquadrate, depressed at the vertex, black and shining. Width, .6 mm. Body furnished with

minute tubercles, a spined process at each side of the cervical shield and two tail-like appendages which take the place of the anal feet. Color black throughout a little paler ventrally.

*Second stage.* Head rounded, minutely punctured, with a tubercle below the vertex of each lobe. Color purplish black, a little paler about the sutures of the clypeus (triangular plate). A few short hairs. Width .9 mm. The body has several rows of minute piliferous tubercles, two large, thick, heavily spinose cervicle horns on joint 2; tails, long, sharply spinose, shiny black, the extensile threads purple black, whitish at base. Body velvety purple black, the venter greenish. Length of body 4 mm., of tails 4 mm.

*Third stage.* Head with two tubercles before the apex of each lobe, one in the centre of and one each side of the clypeus. Color, dull black, clypeus and mouth reddish, ocelli black, antennae pale. Width 1.3 mm. Cervical horns thick, heavily spinose, the spines blunt and each tipped with a hair. About six rows of elongated piliferous tubercles on each side, alternating anteriorly and posteriorly on each segment. Tails long, heavily spinose, black, the extensile threads brown, white at base. Body and legs greenish yellow, a black dorsal band covering the cervical horns, narrowing to joint 4 where the dorsum is angularly elevated, widening to near the spiracles on joints 8 and 9, then continuing evenly over the subdorsal space to the last segment. Spiracles narrowly black ringed. Length of tails, 5 mm.

*Fourth stage.* Head dead purple black, greenish at the sides posteriorly, the upper half sprinkled with little yellowish dots, but leaving a line of the ground color each side of the central suture.

Clypeus and mouth, paler and shiny: antennae whitish, ocelli black. Width 2.1 mm. Body as before, considerably elevated dorsally at joint 4 with a rounded pinkish dorsal process. Cervical shield large, purplish black, the horns rather thick and short, heavily tuberculated. Body yellow-green, the dorsal stripe black as before, but a little purplish, spiracles white with a fine black border, the posterior ones more or less surrounded by black. Tails heavily spinose, black; length 7 mm. The piliferous tubercles of the body are very small, those on the lateral region white besides many small lateral white spots. A narrow yellowish stigmatal line. Two erect spiny black hairs beyond the anus.

As the stage advances, the spines on joint 2 become partly white, the dorsal band partly striated and indistinctly bordered anteriorly with white, the stigmatal line just below the spiracles is white and there is a general approach to the next stage.

*Fifth stage.* Head rounded, rather flat in front, shagreened. Color black, green at the sides posteriorly, a large band in front as wide as the space between the eyes at base, but narrowing to the vertex, sordid white, mottled a little with the ground color. Labrum whitish; maxillae black; antennae

white. Width of head 3.7 mm. Cervical shield large, angulated at the corners without any horns or spines. Beneath it the head can be partly retracted. Body angularly elevated at joint 4 with a dorsal fleshy process. Tails 9 mm. long, whitish above and green below at the base, the rest purple with black spines. Extensile threads yellowish at base, then red fading to yellowish again towards the ends. Body green, a broad white dorsal band edged with white, confusedly striated on a purple ground which soon becomes green, a little purple on joints 2-4, decidedly so on the anterior corners of the cervical shield (where it shades into pinkish in the fold of skin behind the head) on the hump on joint 4 and on joint 8 subdorsally in the angle of the band. It begins broadly on joint 2 covering the cervical shield, narrows to the process on joint 4, widens to just above the spiracles on joint 8 and gradually narrows to joint 13, where the anal plate is greenish. A distinct white substigmatal line, edged below with brown and narrowly above with black, absent on joint 2 and turned up at its anterior end. Many small lateral white flecks. Spiracles, black, white centrally. Thoracic feet twice lined with black longitudingly; abdominal, once transversely, the claspers tipped with black. Length 25 mm. exclusive of the tails. The erect spines beyond the anus, whitish. When the larva has finished eating, all the white of the dorsal band except its borders fades out, leaving the back green and the cervical shield pale blue.

*Cocoon.* Formed on wood of gummy silk strengthened by many little pieces of bark and wood bitten off from the inside, thus forming a hollow. It is elliptical, just large enough to contain the larva and becomes very hard, closely resembling a lump or excresence on the bark.

*Pupa.* Cylindrical, tapering a little towards both ends, the last two abdominal segments rounded and appressed, the others capable of motion; no cremaster. Eyes prominent; a narrow carinated ridge runs along the head from between the eyes to the back of the place of origin of the antennae. Cases creased and very minutely punctured, not shiny; eyes and body sublustrous, the latter minutely granulated at the anterior half of each abdominal segment; spiracles distinct. Color dark reddish brown, with a blackish shade over the dorsum. Length 18 mm., greatest width 6.5 mm. Pupation occurs in about two weeks after the completion of the cocoon and the insects remain in this stage throughout the winter.

*Food plants.* Willow (*Salix*), Poplar (*Populus*). Larvae from Dutchess Co., N. Y.

# NOTES ON THE EARLY STAGES OF TWO SPHINGIDAE.

BY ALPHEUS SPRING PACKARD, PROVIDENCE, R. I.

It is evident that what little we know, notwithstanding all the effort which has been made, of the life-histories of our *sphingidae*, will have to be done over again in a more thorough and systematic way, while each stage should be very fully and comparatively described, in order to ascertain the probable relative age both of the species of the genus, and of the genera themselves. In this way we shall be able to arrive at a probable phylogeny of the sphingid family; i. e., we may discover the ancestral forms, i.e., those which have through adaptation survived many ages, and the later, more highly modified species, which are the result of adaptation to newer, changed conditions. One may feel sure that in this attractive labor, he will derive great intellectual benefit and stimulus. It will not only cultivate his powers of observation, but add to habits of reflection, and draw out whatever latent philosophical capacities or tastes may have laid dormant in his nature. In such work Weismann's beautiful "Studies in the Theory of Descent" will be the student's guide, and it is greatly to be desired that our younger lepidopterists should obtain that work and make a careful study of it. From our limited experience in rearing only two or three sphingids, and a number of bombyces, we feel confident that the facts and theories in that stimulating work are as a rule well founded; and we are glad to acknowledge our great indebtedness to the learned and thoughtful author. As the work is well translated by Prof. Meldola, and can be had at a very moderate price, far less than the original cost, there is little excuse for not buying it.

Thus far we have perhaps not a single thorough and well illustrated life-history of any of this group, and we are still in much the same condition that they were in Europe, before the publication of Weismann's work. This is not written to depreciate in any way the excellent and honest work which has been done by Messrs. Lintner, Riley, Hulst and others. What we mean to say is that the life-histories thus far published, have not been worked out with reference to the origin of the markings, the lines, stripes and spots; nor with reference to the probable relative ages of the species, nor to the position in nature of the different genera, so as to enable us to determine which are the older or simpler forms, and which the more recent, more modified genera, or species. The work can hardly be done by one person, or in even several seasons, but should a few coöperate, a great deal of desirable work could be in the course of a few years performed.

The few notes below were made during the past summer on two forms allied to those interesting genera *Deilephila*

and *Thyreus*, as well as *Philampelus* and *Chaerocampa.* I had no intention of doing any work in this family, and the notes are not intended to be at all final, but imperfect as they are, they show how interesting it would be to know something of the early larval stages of the American species of *Amphion*, *Thyreus*, *Enyo*, *Deilephila*, *Philampelus*, and certain tropical forms, to which the genera in question are allied.

### *Life-history of Deidamia inscriptum.* (*Harris.*)

Mr. James Angus, of West Farm, N. Y. had the goodness to send me the eggs of this sphingid, which is allied to *Thyreus abbotii*, and I was able to carry it through its stages, while in Brunswick, Maine. As the climate is much cooler there than in New York, the nights especially being much lower in temperature, the length of the different stages will probably be found to be much greater than in New York, The larva, according to Mr. H. Edwards's very useful Bibliographical catalogue of the described transformations of North American lepidoptera, has been briefly described by Strecker (Rhopal. et Heteroc.; 112) and by Fernald (Sphingidae New England, 70,) but the early stages have not yet been described. The description of the larva in Strecker's work was however given him by Mr. John Akhurst, from memory, and Prof. Fernald's description is simply copied from Strecker. According to Akhurst the larva is "full-grown about the last of June or beginning of July, and is single-brooded, the perfect insect appearing about the middle of May. Several moths issued in Providence the end of May and early in June from pupae kindly given me by Mr. Angus, but though several males and females were placed within the mating bag no fertilized eggs were obtained. The eggs from which my larvae were bred were received from Mr. Angus, 24 June 1890.

*Egg.*—Rounded oval, rounded alike at each end, somewhat longer than broad, length 2 mm.; greenish in color. The shell is thin, smooth when examined under a Tolles triplet of high power, and also under a ½ inch Tolles objective, but with the latter, scattered roughnesses are perceivable, though not forming true granulations.

*Stage I.*—Just hatched on the morning of 27 June. Length 3½ to 4 mm. Head rather larger, wider than the body, which tapers somewhat from the prothoracic segment to the end. It is uniformly smooth, pale yellowish green, the head being exactly the same color as the body. There are on the body no spots or markings of any kind. The body is provided with long slender sparse, grandular, slightly bulbous hairs, about one-third as long as the diameter of the body, which arise from small minute conical warts. The hairs on the head taper to a fine point.

The very slender, filamental "caudal horn" is, if anything, slightly longer than the body; it is held erect, perpendicularly to the body, and is shining black and very hairy, the hairs being

short and fine, those in the middle of the horn not being one half as long as the diameter of the appendage. The horn is very slightly divided at the end into two tubercles, each bearing a bristle.

30 June, having fed for two or three days they are now larger than before, being 6 to 7 mm. in length, and now the head is no wider than the body, the latter having after two or three days' consumption of food filled out, so that the body does not taper so much toward the end. There are as yet no spots or stripes on the body. The piliferous warts are present, the four dorsal ones being arranged in a trapezoid; they are faintly marked, and green in color.

At the end of stage I, about 3-4 July the body had grown so that the caudal horn was scarcely two-thirds as long as the body, when 6 to 7 mm. in length. There are now, just before ecdysis, faint traces of a diffuse yellowish line, which is seen more distinctly in stage II, and the granulations on the skin are more distinct than when the larva was first hatched.

*Stage II.*—4-5 July. Length 10 mm. The head is now about as wide as the body, not quite so wide as where the body is thickest, *i.e.*—at the first abdominal segment. The caudal horn is now only half as long as the body, and is black and hirsute. It is distinctly divided at the end, each lobe bearing a seta as long as the horn at the end is thick. About eight rows of granulations cross each segment, and there is now a faint greenish-yellow lateral line; but no traces of the oblique lateral stripes can be seen until at the end of the stage. The hairs now have lost their bulbous shape, and taper somewhat to the end. It usually rests on the midrib of the under side of the leaf in this and the preceding stage.

*Stage III.*— 9-11 July. Length 20 mm. The head is now proportionately small, narrower than the rather thick body, which is a little swollen on the 3rd thoracic and 1st abdominal segments. The caudal horn is only as long as the body is thick; it is black, becoming pale at the tip, and green on each side at the base. There are eight wrinkles across the back of the basal abdominal segments.

There is a very narrow dorsal dark green thread-like line, and a much wider diffuse subdorsal line, the two meeting at the base of the caudal horn; below is a whitish green lateral line also ending on the base of the caudal horn. The oblique lines are yellowish, and much more distinct than at the close of the preceding stage; the bars only extend from the hinder end downward to the front edge of the same segment, not extending upon the next segment. The spiracles are green, not ringed, but bearing two obliquely vertical parallel twin oblong fine black dots. The wrinkles are well marked on the dorsal surface; lower down the sides they break up into raised white spots or granulations. The suranal plate is faintly edged with yellowish.

*Stage IV.*—Moulted 14 July. Length 25 to 30 mm. The head is pea-green,

with a yellowish stripe on each side, continuous with the subdorsal stripe along the body, which is now broad and diffuse, with a dark green shade above it. The lateral yellowish stripes as before. The horn is a little shorter than in the preceding stage, and the green at the base on each side encroaches more on the black, extending higher, while the extremity of the horn is tipped with green, in one specimen distinctly so. There are eight transverse wrinkles to each segment, and the white granulations are more distinct than before. The spiracles are white, with two twin vertical elliptical spots on each side nearly meeting in the middle.

In this stage when disturbed the caterpillar will turn the head, and the front part of the body, represented by the three thoracic segments, over upon the back of the abdominal region so that the feet are held up vertically, as in Datana and other larvae.

*Stage V.*—Last stage, moulted, 21-22 July. Length 54-55 mm. The head is as in the previous stage, but rather more angular on the sides. The lateral yellowish line on the head is very distinct and continued as distinctly on the thoracic segments as far as the middle of the 3rd thoracic segment; beyond this the line is indistinct on the three following segments, becoming distinct again behind the middle of the body.

The prothoracic segment is a little wider than the head, and about one-half as wide as the 3d thoracic segment. The lateral yellowish stripes are distinct, not reaching either the front or hinder end of the segments. The caudal horn is now yellowish; the subdorsal yellowish lines ending on it; it is about one-half as long as the 8th segment is wide when seen from above, and is finely tuberculated with dull amber-colored warts. The upper side of the body is yellowish-green, but the under side is almost exactly of the hue of the under side of the leaf of Ampelopsis, being of a rich soft pea-green and less distinctly and prominently papillated than above. The thoracic legs are yellowish-green.

27 or 28 July it began to contract in length in preparation for pupation, and it assumed the pupa state 30 July.

Duration of stage I, about 7 days; of stage II, 5 to 6 days; of stage III, 3 to 6 days; of stage IV, 6 to 7 days; of stage V and last, about 6 days; of the prepupal stage from 2 to 3 days. Total duration of larval life, about 33 days.

### *Summary of the most important changes.*

1. The glandular bulbous body-hairs disappear after stage I.

2. The caudal horn is at the time of hatching slightly longer than the body.

3. Faint traces of the yellowish lateral line appear at the close of stage I, but no oblique stripes.

4. Traces of the oblique yellow stripes appear at the end of stage II.

5. In stage III the body begins to be swollen on the three thoracic and the 1st abdominal segments. All the distinc-

tive lines and markings of the last stage are now indicated. It is also probably the rule among the bombyces, judging by many cases I have observed, that by the 3d stage the larva now large and living more conspicuously, assumes the general shape and coloration of the fully fed caterpillar.

*The life-history of Ampelophaga myron (Cramer).*

Two of the larval stages have been described by Lintner (Proc. Ent. Soc. Phil. v. 3) the length of his youngest larva being .50 inch; the other stage being the final one. Riley (2d Missouri Rept. 71-73) has briefly described the egg, the first and last stages. I am also indebted to Mr. James Angus for the eggs of this sphingid which were sent from New York at the end of June. The larvae were hatched 2 July 1890, and fed on Ampelopsis leaves.

*Egg.* — Rounded oval. Length 2½ mm. The shell, under a Tolles triplet is smooth. It is of the same shape, size and appearance as that of *Deidamia inscripta.*

*Stage I.*— Hatched 2 July. Length 5 mm. The larva in this stage, especially at the time of hatching is not only seen to be similar to that of *Deidamia inscripta*, but is under a high power Tolles lens not even distinguishable from it, unless the caudal horn be slightly shorter and less hirsute in the present species. The head is at first larger and broader than the body, and of the same color. Prothoracic segment with a dorsal crescentic shield or flat surface. The caudal horn is long, black and when observed under a high power Tolles triplet, hirsute. The legs are concolorous with the body. Behind the base of the caudal horn both in this and *D. inscripta*, is a deep orange-red discoloration or transverse streak. The body is now wrinkled transversely above. The hairs are glandular, and slightly bulbous at the end.

Three days later, after feeding, and compared with larvae of *D. inscripta* of the same period the body seems to be in *A. myron* a little slenderer, and it also differs in the sutures being slightly yellowish, while the head is of a paler greenish tint. The glandular hairs are of about the same length as those of *D. inscripta*, but perhaps the tubercles are more prominent.

*Stage II.*—Moulted 9 July. At first the caudal horn is flesh-colored, afterwards turning dark. By 11 July it had grown to the length of 10 mm. And now the caterpillar is quite different from that of *D. inscripta* of the same stage. The body is very slender, the head slightly wider than the body. Each segment has eight wrinkles or folds of the skin which is also spotted with white raised dots. The sutures are yellowish green, contrasting with the body. The caudal horn is pale reddish-chestnut, becoming darker at the extreme tip, which is slightly but distinctly divided at the end, each lobe bearing a bristle. There are as yet no lines or oblique stripes visible.

*Stage III?* Length 17 mm. 18 July, it had probably moülted, but I did not see

it in the act. The head is as wide as the prothoracic and middle body-segments; the 3d thoracic and 1st abdominal segments are by this time somewhat swollen. A distinct narrow white lateral line is now present, while the dorsal region between the two lines is paler than on the sides of the body. The head is now rough with small pointed tubercles. There are no lateral oblique stripes present. The caudal horn is reddish flesh-colored, becoming darker at the tip.

*Stage IV.* Length 25 mm. Moulted 24 July. This I suppose to be the third moult. The head is long, somewhat lengthened towards the vertex, and slightly flattened on the sides; the surface is unequally tuberculated with sharp conical white tubercles arranged in irregular longitudinal lines. There is along each side of the head a broad, yellowish lateral stripe, and a faint yellowish shade along each side of the median suture. The yellowish line on the side of the head is continued on the body as a subdorsal whitish line, which is faint on the prothoracic segment; this line behind the middle of the 3d thoracic is formed of a row of rather large conical tubercles, it again becomes continuously white on the 7th and 8th abdominal segments, fading out at the base of the caudal horn, which is whitish, with sharp, slender black tubercles on the upper and under side of the horn, the tubercles on the sides being white; the tip of the horn is flesh-colored, and the entire horn is nearly twice as long as the body is thick. The spiracles are raw-sienna brown, with a white spot at each end of the respiratory slit above and below. The thoracic legs are peculiarly spotted with black on the green base, and are reddish cherry at the ends. All the abdominal legs are greenish. The body is thickest on the 3d thoracic and 1st abdominal segment. On the 2d thoracic to the 5th abdominal segment are faint oblique lateral whitish stripes, bearing white obliquely-arranged white tubercles, those on the first three abdominal segments more distinctly underlined by white. It died 5 Aug., when nearly full-fed.

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NOTE ON TWO SPECIES OF DATANA.—From my remarks after the two species of Datana which I described, (Psyche, v. 5, p. 299-300,) it might be inferred that they were compared with a number of allied species. I would like therefore to state that *Datana modesta* was compared with the type of *D. floridana* in the collection of Mr. Edward L. Graef, and that *D. palmii* was compared with a type of *D. integerrima* G. & R., in the collection of the late Coleman T. Robinson, now in the American museum of natural history, N. Y.

*William Beutenmüller.*

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EDWARDS'S BIBLIOGRAPHY OF TRANSFORMATIONS.—It will be strange if an impetus is not given to the study of the earlier stages of lepidoptera in this country by the bibliograhy of the literature of the subject, prac-

tically complete, which Mr. Henry Edwards[1] has recently published. Of course, in the nature of things, it is a simple compilation; but since our actual knowledge of the perfect insects in the lepidoptera is out of all relation to our knowledge of their earlier conditions and their life histories, every contribution which tends to lessen the disparity is a distinct gain. We therefore particularly welcome the present work as one likely to have a marked influence in that direction especially if followed up, as the author promises, by annual appendices.

The insects concerned are systematically arranged, following the lists of Edwards, Grote, Fernald and others; under each species the recorded transformations, whether given in description or figure are arranged (generally in a single line) chronologically, a form of exposition which has a definite value as showing in so many cases the advance of our knowledge and the sources of borrowed material; finally the food-plants are given, not always so fully or specifically as might have been done. Short descriptive words such as "condensed" or "quotes French" etc. often characterize a reference briefly to indicate its value, and we think a more liberal use of comments in this brief form would have added much to the usefulness of the catalogue, and would have required little more work if undertaken from the outset. The labor of such a bibliography, however, necessitating exactitude at every step can be appreciated only by those who have tried it; and the last straw may sometimes break the poor camel's back. Nearly nineteen hundred species are indexed, and sixty-five authors cited.

As our knowledge of the lepidoptera of North America may almost be said to have originated in the famous folios of Abbot and Smith which a century ago recorded and pictured the transformations of so many species, many indeed hardly ever bred since then, it is not surprising that the earlier stages of lepidoptera should always have had their devotees in this country, and that, all things considered, our country is as well known in this respect as we could expect. That, however, a wealth of material lies untouched at our very doors the pitifully meagre entries which have often to be made in this bibliography bear abundant proof, while a comparison of this list with those of the known species should make us rather ashamed than proud of the record which Mr. Edwards holds up before us. We commend this book to the American lepidopterist as the most important work of reference he can have in his library.

[1] Bibliographical catalogue of the described transformations of North American lepidoptera. By Henry Edwards. Bull. U. S. Nat. Mus., No. 35. 8vo. Washington, 1889, pp. 147.

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DO FLIES MIGRATE?—Some years ago, early in September, I saw a migration of butterflies, *Anosia plexippus*, at Little Boar's Head, N. H., which I have recorded in my Butterflies of the Eastern U. S., v. 1, 730. They were moving southward along the shore. One afternoon at the end of last July, July 27 to be exact, I was sitting on the shore itself, backed by a bank, within gunshot of the same spot at which I had seen the flight of *Anosia*, when my attention was directed to the constant southward movement of small flies. There was practically no wind, but the flies moved swiftly in one direction for the space of two hours, forming a stream such as might readily pass through an open barrel; their numbers varied; at times but 3 or 4 would pass a given point every second; at other times hundreds; but on the average they were as many in the given area as drops of rain in a smart shower; rarely one would be seen moving out of the stream, and then it was in a diametrically opposite direction, and just as swiftly. I should add that the direction was evidently influenced in part by the trend of the low bluff at the base of which I was sitting, and I did not go elsewhere to observe them. The stream was not more

than three feet distant and only a few inches above the ground. The flies appeared to belong to a single species as several were caught for identification, and prove to be a species of *Ilythea*, one of the *ephydridae*, and probably the European species *I. spilota*, as that is the only one recorded from this country. I shall be glad to know if such streams have before been observed among *ephydridae*.

*Samuel H. Scudder.*

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The Supposed Bot-Fly Parasite of the Box-Turtle.—During the autumn of 1889 Mr. W. H. Ellsworth donated to the Milwaukee Public Museum a pair of box-turtles (*Cistudo carolina*), which were taken near Windsor, Ct. They were kept alive during the winter in a terrarium, but the female died 5 April 1890. My friend, the talented taxidermist, Mr. C. E. Akeley, while skeletonizing this specimen called my attention to a peculiar swelling in the animal's neck. Closer examination showed that the cutis close to the carapace and a little to the right of the median dorsal line, had been converted into a pocket about ¾ of an inch in diameter. This pocket opened on the surface by means of a very small aperture and contained besides a quantity of suppurative matter, eight maggots which I at first took to be bot-fly larvae. Both their shapes and positions with reference to the inner surface of the cavity which they had excavated reminded me of the *Gastrophilus* larvae so often exhibited in the shops of veterinary surgeons. Such of the larvae as had not been injured during the removal of the skin and flesh from the cervical vertebrae of the turtle, buried themselves in the earth 14-15 April and pupated. The imagines made their appearance 27 May and proved to be not bot-flies at all, but a species of *Sarcophaga*.

Prof. S. W. Williston has directed my attention to the following note by Packard (American naturalist, 1882, v. 16, p.598):

"The museum of Brown University has received specimens of a bot-fly maggot, of which eight or ten were taken, according to Prof. J. W. P. Jenks, from under the skin of the back of the neck, close to the shell of the box-turtle (*Cistudo carolina*). The turtle was collected at Middleboro, Mass." * * * *

"It appears to be a genuine bot-fly, but quite unlike any genus figured by Brauer in his work on the *oestridae*.

The body is long and slender, cylindrical, tapering so that each end is much alike. The segments are provided with numerous fine spines, which are not entirely confined to the posterior half or two thirds of the segment. The body is slender and the spines much smaller than in *Gastrophilus equi*."

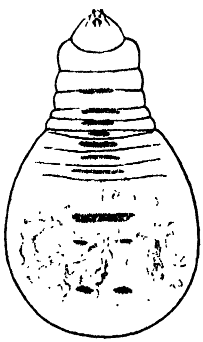
A comparison of this account with my observation given above leaves no doubt that the larvae seen by Packard and myself are specifically identical. I have also compared one of the maggots with Packard's figure and description and can detect no differences. The error into which he has fallen is pardonable, inasmuch as the *Sarcophaga* larvae are microscopically so similar to bot-fly maggots that any entomologist unaccustomed to the minute study of dipterous larvae would not hesitate to allocate them to the *oestridae*. Until the flies appeared, I was quite sure that I had found a bot-fly infesting a reptile. (See Proc. acad. nat. sci. Phil., 1887, p. 393-394; 1888, p. 128; Science, 5 December 1884, v. 4, p. 511.)

It would seem to be a regular habit with this fly to infest *Cistudo carolina*. That the eggs or young larvae are laid on the living turtle there can be no doubt, but whether they are deposited in a sore, or on the unabraded skin of the nucha, as being a region inaccessible to the turtle's beak and claws, remains to be seen.

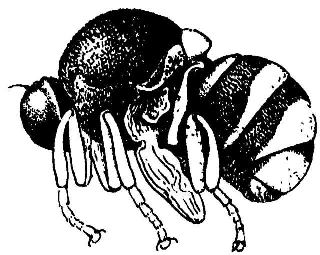
The four imagines which I succeeded in rearing proved to be females and though the species appears not to have been described as yet, I would rather wait till male specimens can be secured, before attempting to add another member to the large and very difficult genus *Sarcophaga*.

*W. M. Wheeler.*

**An Internal Dipterous Parasite of Spiders.**—In the spring of 1887 while hunting for spiders in company with Mr. G. Dimmock in the cracks on the steep sides of some rocks near Roberts Station in Waltham, Mass. I found hanging in cobwebs several soft white maggots and pupae. The webs were generally old and out of repair and a closer examination showed that there were no living spiders in them but in almost every one an empty skin of a common spider, *Amaurobius sylvestris*, nearly full grown. The skin of the legs and thorax was not clean like a moulted skin but dirty and opaque as though eaten out and the skin of the abdomen when present was torn and shrivelled. From this I concluded that the maggots came out of the spider and from their size must have nearly filled them. The maggots varied considerably in size the largest being a quarter of an inch long while others were not much more than half as large. The hinder half of the body was thicker than the front half and nearly spherical.



They hung head upward holding to the web by their jaws and were also partly supported by threads under and around them. I was unable that season to raise the adult fly some of the larvae being injured in carrying them home though kept in cobwebs and cotton wool and the others dying apparently from too dry air within a few days. In May 1889, I again found in the same locality several other specimens also in abandoned cobwebs and with the dead and empty spiders as before and among them one pupa far enough advanced to grow to the adult condition though the skin dried so much that it had to be torn off and the fly never expanded its wings properly. It turned out



to be a species of *Acrocera* belonging to a family several species of which have been found parasitic in the same way in spiders. In his monograph of the spiders of Prussia (Schriften der Nat. Gessel. Danzig 1863-1866) Menge mentions a similar case. He kept in the house a female *Clubiona putris* in its nest attached to a heath plant. After a few days the spider died and shrivelled and in its place was a maggot suspended by a thin web across the nest. Next day it pupated and a week later there came out the fly, *Henops marginatus* Meigen.

F. Brauer (Verb. d. Zool-bot.-gessel. Wien, 1869, p. 737) describes *Astomella lindenii* Er., which came from *Cteniza ariana* Koch, a trap-door spider from Corfu. The pupa and larva skins were found in the tube and also the dead spider with the abdomen shrunken and having in front a large hole from which the maggots had escaped.

Both these flies belong to the *acroceridae*. My specimen has been examined by S. W. Williston who thinks it is either *Acrocera fasciata* or a species closely related to it.

*J. H. Emerton.*

## ENTOMOLOGICAL NOTES.

Dr. William Patten has been appointed professor of biology at the University of North Dakota at Grand Forks.

Dr. Clarence M. Weed, of the Ohio experiment station, has editorial charge of the department of entomology of the American naturalist.

Mr. Jerome McNeill of Moline, Ill., has been chosen professor of biology and geology at the State University of Arkansas at Fayetteville.

CORDULINA.—In a note to Dr. H. A. Hagen the Abbé Provancher writes that he has not visited Mt. Yamaska since 1877. So far as known his original specimens of *Epitheca yasmaskanensis* are the only ones extant. Mr. Lintner also writes that he has not taken *Cordulia lintneri* since his first catch.

KOLBE'S GUIDE.—Part 4 of Kolbe's German Guide to the knowledge of Insects, p. 177-224, is entirely devoted to the antennae and mouth-parts with a large number of simple but instructive and mostly original figures. This excellent work was originally announced to be completed in six or eight parts, but as the author has not yet covered more than one-sixth of the ground he laid out in his prospectus, it is more likely to continue to twenty.

GREENLAND INSECTS. — Aurivillius has begun in the Handlingar of the Swedish Academy a study of the insect fauna of Greenland, which he is undertaking with his usual thoroughness, as the first instalment, including the lepidoptera and hymenoptera, shows. It is accompanied by three plates, and several excellent figures in the text. He records 28 species of lepidoptera and 17 of hymenoptera. The most numerous genera of lepidoptera are Agrotis, 5 species, Plusia and Hadena, 4 species each. The only new species are one each of Anarta, Pimpla and Banchus.

EARLY LAST AUGUST a green cockroach of considerable size, *Panchlora nivea* (Linn.), was found alive, with a multitude of young ones just hatched, in the bath room of a house on Lafayette St., Salem, Mass., and sent to Mr. S. H. Scudder for determination by Prof. E. S. Morse. It is a native of Cuba aud Central America. It is curious that Mr. Scudder has also in his collection a specimen marked as found flying in a store in Boston, 26 December, 1878, on the authority of the late Dr. Samuel Kneeland.

THE APPLE MAGGOT, *Trypeta pomonella*, is the subject of an elaborate report by Prof. F. L. Harvey of the Maine State College. The investigations were made in 1888 and 1889 chiefly at Orono, though the date and place of publication are not noted. The species is described and figured in all its stages and its life-history and habits are given in detail. As the larvae do not leave the fruit until it falls from the trees the thorough and universal destruction of windfalls is recommended as the best remedy.

LEPIDOPTERA INDICA. — Three parts of Moore's Lepidoptera Indica, including 80 pp. of letter press and 24 plates, have now appeared and the author has not yet more than half completed the *euploeinae* with which he begins his work and of which thirteen genera and thirty-five species are so far characterized; this gives a lively impression of the difference between that fauna and our own. The additions to our knowledge of the earlier stages are interesting; the caterpillars and chrysalids of seven species are given (from one to three figures of each) of as many genera, and their peculiarities certainly seem to support the closer subdivision of these Eastern *euploeinae* of which Mr. Moore has been the foremost supporter. About half of these same species have before had their earlier stages figured, but of these as well the illustrations are new; never before have the *euploeinae* been so well illustrated in their earlier life. All the figures appear to have been put upon the stone by Mr. Moore's son.

**What is the Cause** of the gradual extermination of insects in certain places? Is it the changes incident to growth of population? It is well known that *Chrysophanus dispar* formerly found in England is now no longer known there; as the French might say, dispar has disparu. Mr. Jenner Wier writes that *Aporia crataegi* was a common species in several parts of Sussex, notably at his father's, about 8 miles from Lewes, where it was to be seen in numbers every year, but now for forty years he has seen but one specimen; nor do his Sussex friends take it. He states that it has also disappeared from the New Forest where he used to take it up to ten years ago, and from Monmouthshire, where it was once common.

**The Tenth Part** of the current series of Edwards's Butterflies of North America deals with two species from the eastern half of the continent, two from the western, both of the latter species of Argynnis, of which little more than the bare description is given in the text. Of each of the eastern species, however, *Argynnis alcestis* and *Satyrodes canthus*, a full life-history is given with abundant illustration, and, of course, of the highest excellence as Mr. Edwards deals with no other. The statements regarding the difference of behavior and coloration of different caterpillars of the same species is full of interest and shows the necessity for repeated observations. The exceptional autumn activity recorded of the young caterpillar of *A. alcestis* may possibly have been due to an unwonted climate, as they were transferred while in the egg-state from Chicago to Coalburgh. While one does not like to find fault with a work of such marked excellence, it is a pity that the author cannot find a better way of describing the position of the tubercles of the caterpillar than that employed, which often reads like a multiplication table, locates them vaguely at best, and omits much that is distinctive.

**Long-lived Zopherus.**—Mr. S. H. Scudder has in his possession four specimens of *Zopherus bremii*, one of the *tenebrionidae* from Yucatan, which is used as an ornament to the dress in Central America by being belted and chained with gold; the natives call them Makatch and they are popularly supposed to live on air. They were received from Stephen Salisbury Esq. of Worcester who has had them alive for five years. They have been kept in a wire cage in which is a large piece of half decayed wood, which they evidently gnawed more or less, making some chips, but whether or not they devoured it was a matter of doubt until some birch fungi were introduced; these seemed to meet with more favor and especially one which had a partially black interior; it was soon seen that some of the chips were of a darker color, and examination showed in all, both gray and black, a remarkable uniformity in size; closer scrutiny showed them to be unquestionably faeces, all being of the same form and made up of a pressed agglomeration of vermiform series of particles. The amount however is ridiculously small, for a dozen of these beetles together would not furnish a thimble full in a year.

**Notice of Meeting, Association of Official Economic Entomologists.**

The second annual meeting of the Association of Official Economic Entomologists will be held at the university buildings, Champaign, Ill., November 11th to 15th proximo, at the same time and place as the meeting of the Association of Agricultural Colleges and Experiment Stations. The committee on Entomology of the latter association will meet at the same time.

Members expecting to attend, will confer a favor upon the officers if they will announce the fact, and will send titles of papers to be read or topics they desire discussed to the Secretary.

All are earnestly requested to be present if possible.

John B. Smith, Secretary,
New Brunswick, N. J.

No. 169 was issued 10 May, 1890.
" 170 was issued 11 July, 1890.
" 171 was issued 19 August 1890.

# PSYCHE

## A JOURNAL OF ENTOMOLOGY.

[Established in 1874.]

**Vol. 5. No. 175—176.**

NOVEMBER—DECEMBER, 1890.


*CONTENTS:*




PUBLISHED BY THE

CAMBRIDGE ENTOMOLOGICAL CLUB,

CAMBRIDGE, MASS., U. S. A.

YEARLY SUBSCRIPTIONS, $2. VOLUME, $5. MONTHLY NUMEROS, 20c.

[Entered as second class mail matter.]

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PSYCHE.

# NOTES ON SOME APHID STRUCTURES.

BY JOHN B. SMITH, NEW BRUNSWICK, N. J.

DURING the season of 1890, the most notable feature in New Jersey was the enormous increase in the numbers of the *aphididae*. Naturally, as complaints of injuries were received, I was compelled to pay some attention to these insects, and a Bulletin of the Station has been prepared treating of some of the more injurious forms. It is part of my creed, whenever I look at an insect, whatever its order, to see all I can, and so far as the characters are interesting, and bear at all on the philosophy of economic entomology (for I believe that economic entomology is simply the philosophic application of the facts ascertained by a technical study to the practical needs of Agriculture), I do not hesitate in presenting them in a popular way in the Bulletins of the Station. Sometimes the facts observed have, or may have a technical bearing, and as the Station Bulletins under present circumstances are hardly ranked as technical publications I prefer to present them in another form in the technical journals also.

The principal points studied were the beak and antennae. So far as the latter organs are concerned there is room for a great deal of histological work, and much more use than has been made, in systematic entomology.

Perhaps, after the examination of the heads of lepidoptera and diptera, the most prominent feature that challenges observation is in the eyes. These do not have hexagonal facets as usually described for insects, but there is a simple aggregation of quite strongly convex circular lenses, each quite distinct from all the others, externally, and each undoubtedly capable of receiving a complete image in itself. The very strong convexity of the lens makes it very probable that the insects are excessively short sighted. When the head has been macerated in potash, the framework of the eye appears as though the setting for the lenses had been punched out with a round punch. I take this to be a much more simple eye formation than that of the *tabanidae* for instance.

The antennal structure derives its interest from the imbricated or scale like markings of the surface, sometimes confined to the terminal joints only, sometimes present on all, and from the system of sensory pits or pores.

In reference to this last I have found it invariable on all the specimens of the

same species, and this ought to furnish a most important character in the separation of species. The system is alike in no two species hitherto examined by me, though this may not hold good throughout the family.

Another very important point struck me. In none of the wingless forms does the poriferous system attain the complexity found in the winged forms. From the young louse just born, to the pupa, the poriferous system remains the same, and is very similar in all the species; but when the winged form is assumed, the specific poriferous system makes its appearance. It is well to say here, that I have not examined the true sexes and can say nothing of any species in the sexually perfect condition. In all the wingless viviparous females examined, the larval poriferous system was retained, and *I conclude therefore that we have to do, really, with a true reproduction among larval forms, and that wingless viviparous females among aphididae are not mature insects in any sense of the term; but that they represent simply an arrested larval stage, which under other conditions would develop into a winged form.* The winged viviparous females are ultimate or mature forms in which both sexual elements are represented in the form of the original germ cell, which by budding, develops the embryo brought forth. It seems rather elementary, but equally necessary to explain, that the term "budding" as used in reference to this method of reproduction, is a budding of the germ cell, and not a budding from the body of the insect; but in this latter sense I find that the term is quite generally understood.

With these, preliminary, observations and conclusions, I will proceed to details.

In all the aphides examined the first or basal joint is subglobose, stout and short; the second is also short, but scarcely globose; the third is the first of the long joints and it is longer than either the 4th or 5th, which are subequal in length, and sometimes is as long as both together. The sixth, or terminal, is what I have termed the whip joint. It enlarges gradually from the base for a short distance and is then rather abruptly narrowed from one side, giving a false appearance of segmentation. From this point it continues to the tip, gradually tapering to a point. It is flexible, and the resemblance to a whip is not fanciful.

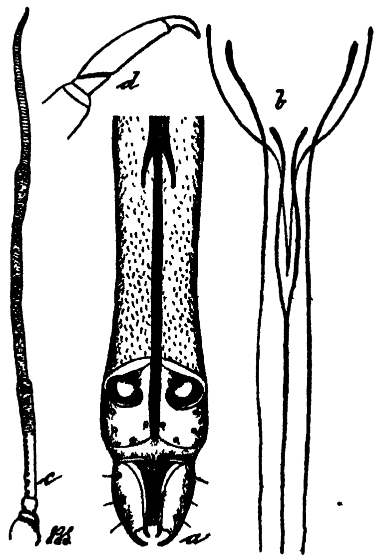


Fig. 1.

In the Wheat louse, *Siphonophora avenae* Fabr., the third joint is visibly imbricated only beyond the middle while all the following joints are obviously imbricated. The sensory pits are confined to a single row of eleven, extending from the base to beyond the middle of the joint. The 4th joint has no sensory pits and the 5th has a small group near its tip, only. The 6th joint has at the point of greatest dilation, and just before the sudden narrowing, a very distinct group of pits, and these are permanent in all stages, and very similar in all species. The absence of these would be a matter of very high systematic value.

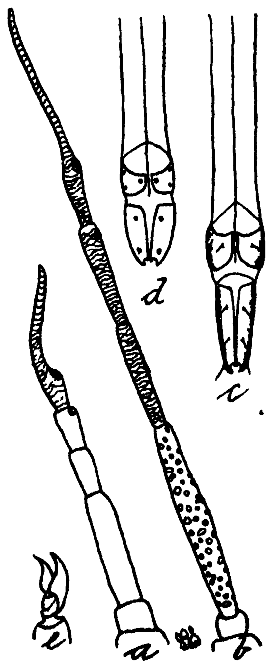


FIG. 2.

In the Cabbage louse, *Aphis brassicae* Linn., the poriferous system is entirely different. The 3rd joint is not, or but faintly imbricated, while the small, sensory pits are scattered all over the surface in no regular series and too numerous to count. In a case like this I should expect a considerable range of variation in the number of pits. The 4th joint is imbricated, as are all the following, but has no sensory pits. The 5th joint is very like that of *S. avenae*, as is also the 6th. In the immature forms the 5th joint is furnished with a single large pit at tip, and the usual small aggregation on joint 6.

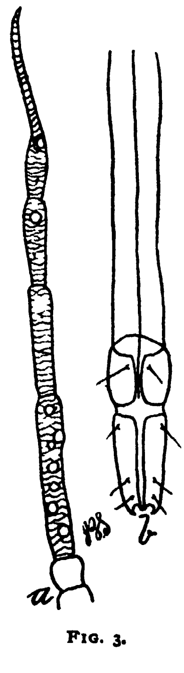


FIG. 3.

*Aphis cucumeris* Forbes, the Melon louse shows a somewhat different type

of structure. All except the basal small joints are distinctly imbricated, and the sensory pits are very much larger than in either of the preceding species. In this species the structure of the pits becomes more evident, but will not be further referred to here, as the Peach aphis affords a more satisfactory subject. The 3rd joint in this species has seven or eight rather irregularly placed pits, extending the full length of the joint. Joint 4 is free while 5 has a single large pit near the tip. Joint 6 has the usual little aggregation, one large pit, margined by several small ones.

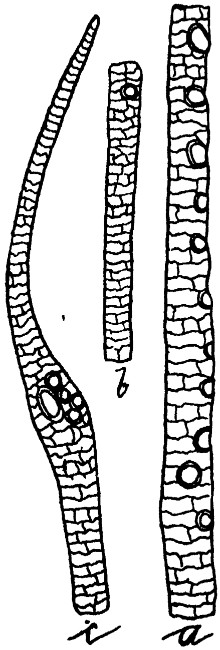


FIG. 4.

In the Cherry aphis, *Myzus cerasi* Fabr., the pores or pits are still larger, and the structure of the pits is still better brought out. On the 3rd joint, which with all subsequent ones is imbricated, there is a series of eleven very large pits in a single line: the fourth joint is free of such pits: the 5th joint has a single large pit near the tip, and the sixth joint as usual has a small group, consisting here of a very large oval pit with four smaller ones grouped at one side.

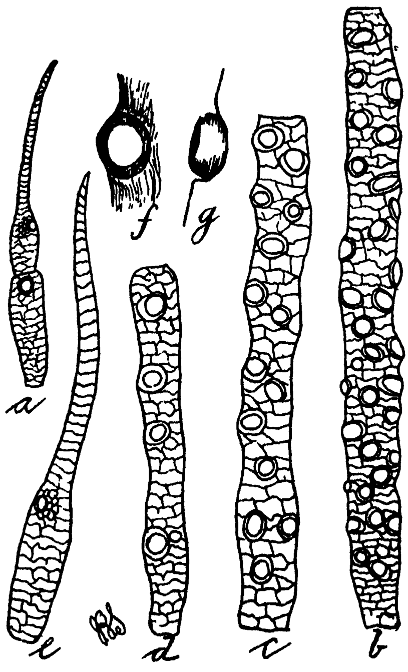


FIG. 5.

Most interesting of all, is the Peach aphid, *Aphis persicae-niger* E. F. Smith. In this species the poriforous

or sensory system attains its most complete development, so far as my observations extend. Every joint, except the small basal knobs, is imbricated, and each is furnished with sensory pits or pores. The third joint is irregular and knobby from the projecting margins of the pits, which are numerous and very large. The figure shows the appearance well, but it must be said that the enlargement of *b*, is only $\frac{2}{3}$ that of *a*, *c*, *d*, and *e*, so that it is really equal to the two following joints in length. Joint four has also a large number of pits, irregularly scattered on all sides, and this is the more remarkable since in none of the other species is it pitted at all. Joint five has four large and two small pits on one side—other not examined—, more also than in the other species. On joint six, on the contrary, the aggregation of pits is smaller than in the Cherry aphid, though the number of small pits is greater. Curiously enough, nothing in the larval antennae indicates this extreme development in the mature form. *All* of the wingless forms have this simple, single pit near the tip of 5, and the usual small group on 6. It has been already indicated that in this species the structure is best made out. This is due to the fact that every part is more thoroughly chitinized than in any other species save *M. cerasi*, and the action of potash and carbolic acid is not so destructive, while the parts are sufficiently cleared for study. We see here that we do not have simple pits to deal with; but rather special sense organs, apparently not directly communicating with the outer air, for on careful examination a fine, tense membrane is seen to close the opening, not from edge to edge, but as if drawn over a projecting rim. It is on a side view that we best get an idea of the structure which is fairly well shown at *f* and *g*. What are the functions of these pits? Not tactile, surely! Olfactory? Why should that require any tense membrane? Auditory? Here the membrane might serve as a drum to catch the vibrations; but why should there be such a differerence in number? Why also do the darker, more chitinized forms have these pits relatively so much larger? These questions are easily asked; but I shall not try to answer them.

Besides the antennae I also studied the mouth parts of these insects and find that there is some small difference in the structure here, shown in the figures given; but scarcely worthy of note, except in the case of the wheat louse. In this species the beak is perhaps shorter and broader than in the others, while the ante-apical segment has on each side a peculiar flap, gouged from the body of the joint and covering loosely the pit thus caused. This is found in all stages of this species, and nothing like it has been found in any other examined by me.

Within this beak are the four bristles, two of them connate except at base, which are supposed to represent the maxillae and mandibles, the beak itself being a modified labium. I wish to decidedly state my disbelief in any such

homology. It is utterly unphilosphocal to accept without the clearest proof such a structural modification as this change in position of the mandibles would require, and the modification of the ordinary labium into a beak of this character is a process that ought to be proven. It seems to be assumed that the "labium" of the hemiptera is the same as the "labium" of the diptera, e. g. *Culex*, and if this is so, I have a paper now in press, in which I claim to prove that this "labium" in the diptera is really only a modified galea, or a maxillary structure. I hope to prove some time in the future, when I can get the necessary material, how this modification of the hemipterous mouth came about, and that the mandibles do not, habitually, become internal mouth structures so long as there are other organs enough more naturally situated.

EXPLANATION TO BASE FIGURES.

Fig. 1. *Siphonophora avenae*. *a*, beak; *b*, bristles of mouth—"mandibles" and "maxillae;" *c*, antenna of winged viviparous female.

Fig. 2. *Aphis brassicae*. *a*, antenna of wingless forms; *b*, antenna of winged viviparous female; *c*, beak of young lice; *d*, beak of mature, winged form.

Fig. 3. *Aphis cucumeris*. *a*, antenna of winged viviparous female; *b*, beak of wingless forms.

Fig. 4. *Myzus cerasi* *a*, 3rd; *b*. 5th; *c*, 6th joint of antenna of winged viviparous female.

Fig. 5 *Aphis persicae-niger*. *a*, antenna of immature forms, joints 5 and 6; *b*, 3rd; *c*, 4th; *d*, 5th; *e*, 6th joint of antenna of winged viviparous female; *f*, sensory pit from front; *g*, same from side.

## NOTES ON TWO SPECIES OF DATANA WITH DESCRIPTIONS OF THEIR LARVAL STAGES.

BY HARRISON G. DYAR, RHINEBECK, N. Y.

Of all the closely related species of this genus, the two which approach each other the most nearly and are most difficult to distinguish in the imago state, are *D. major* and *D. drexelii*. I have elsewhere called attention to the main feature by which they are to be distinguished, which, after all, is only a matter of degree of coloration. The species differ, or rather tend to differ, in other points beside the brightness of the costal shade, namely, in the more entire outer margin of the primaries, and the darker more even coloration of the wings of *D. major*.

The size is the same in both species, there are no markedly distinctive male genital characters, and the lines and

spots are arranged in the same manner; in fact, there is no absolutely constant difference, either in structure, markings or coloration, between the two so far as I have been able to observe, and I have no doubt that specimens may occasionally occur which it would not be possible to refer positively to one species or the other by an examination of the imago alone. It would at first seem that these species must be more closely related than others in the genus, perhaps hardly yet distinct; but when we consider the larval stages, it is at once apparent that they are widely separated, more widely, in fact, than many other species of *Datana* which are readily separable in the imago state. This difference would seem to indicate rather a long inherited similarity between the moths than very recent derivation from a common ancestor. While the moths, it may be, have remained constant to their former type, or undergone a similar development, the larvae have diverged greatly, which would seem to correspond to the general rule in lepidoptera, that the larvae are often the first to vary. The eggs of *D. major* and *D. drexelii* differ markedly: the larval differences appear in the first stage and are kept up and intensified throughout the larval period, and only when the pupa stage is reached, does the close resemblance observed in the moths begin. The cause of the divergence in the larvae, especially at maturity, is not very obvious, particularly in the peculiar ornamentation of *D. major*, which differs from that of all of the other *Datana* larvae so far known.

*D. drexelii* is abnormal only in the predominance of yellow about the prothoracic and the 8th, 9th and 10th abdominal segments,* and this might serve as an excellent protection, in that the bunches of yellow striped larvae with their extremities elevated in their customary position, resemble the little clusters of flowers of the Witch-Hazel with their linear yellow petals, which begin to blossom in September, just as the larvae become conspicuous. What protection, if any, their coloration affords on the Deerberry, their other food-plant, I am unable to say, as they occur almost exclusively on the Witch-Hazel in this vicinity. (Rhinebeck, N. Y.)

But as to *D. major* its curious spots do not resemble anything so far as I can see. It is to be noted, however, that the habits of the two species differ, for while *D. drexelii* are always gregarious, *D. major*, when they do not separate entirely, feed farther apart, and tend to scatter more in the last stage than almost any other species, and the change in ornamentation from lines to spots, which they undergo in the last molt, may be of use to them with their changed habits.

DATANA MAJOR, *G. & R.*

*Egg.* Sub-pyriform, of less diameter and cylindrical for a short distance at the top, recalling the structure of *D. palmii*; flattened at base or a little hollowed; evenly flat on top with a sharp angle between top and sides. Color uniform sublustrous white, a rather

* In this article, I have followed the nomenclature used by Dr. Packard for the larval segments, as it is not possible to describe intelligently the markings of *Datana* by the usual method.

large central black spot, larger than the corresponding one in *D. drexelii*. Greatest diameter 1.1 mm.; at the top .7 mm.; height .7 mm. Laid in groups of from 90 to 100 on the underside of a leaf of the food-plant.

*First stage.* Head rounded, black, shiny; width .5 mm. Cervical shield, anal plate, thoracic and anal feet and the abdominal feet outwardly, black. Body, wine red, a very broad subdorsal and lateral yellowish band nearly entirely replacing the ground color, and each bisected by a narrow red line. Venter without marks. A number of hairs growing from minute dark brown warts. These warts are proportionally larger in this stage than in any subsequent one. Hairs also arise from the cervical shield and anal feet. The larvae at this stage eat the parenchyma of the leaf from above, and when not feeding, rest on the lower surface or on the stems.

*Second stage.* Head rounded, rather higher than wide; shiny black, or with a slight brownish tinge; width 1.1 mm. Body dark wine red, the two pale greenish yellow bands on each side as before, very wide, nearly or quite lacking their central lines, so that all that is left of the ground color above is a narrow dorsal and subdorsal line. Venter wine red with a central narrow pale yellow line. The hairs from the cervical shield are long, the others short, arising from minute warts. As the stage advances, the lateral bands become somewhat more distinctly divided by the ground color and almost white, though still possessing a yellow tinge. During this stage and subsequently the larvae eat the whole leaf.

*Third stage.* Head higher than wide, narrowing a little toward the vertex, depressed at the sutures. Color sordid orange, becoming red-brown, the ocelli and mouth parts black. Width 1.6 mm. Cervical shield black or partly orange; feet and anal plate black, shiny. Body blackish brown, the stripes as before, yellowish white faintly bisected by a fine line of the ground color. Venter blackish vinous, with traces, more or less distinct, of a central white line. Bases of legs and corresponding spots on the apodous segments dark wine red, or orange tinted. Spiracles and the minute piliferous tubercles, black. Hair sordid white, short, but a few long ones overhang the head. As in the previous stage, the lines bisecting the lateral bands become more distinct with advancing growth, the ground color becomes darker, and the bands clear white. In many examples, a subventral line interrupted by the bases of the legs and a central ventral line are to be seen.

*Fourth stage.* Head as before, brownish red becoming darker; the mouth parts, antennae and ocelli, black; width 3.1 mm. Body black, with four lateral clear white stripes on each side, much broader than the intervening spaces, and three narrow ventral lines represented in some examples by a few linear dots only. Cervical shield light brown, anal plate black or partly brown, thoracic and anal feet and the abdominal feet outwardly black; bases of legs and

corresponding spots on the legless segments brownish red. Hair white, thin, longest at the extremities, the minute tubercles black. The lateral bands are not confluent at either extremity, though in some examples, there is a tendency for the third and fourth lateral (above and before the spiracles) to run together in the middle of the body.

*Fifth stage.* Immediately after molting before the colors have become fixed, the stripes are continuous as in the previous stage, but in a few hours the characteristic markings of this stage are assumed. Head as high as wide, rounded, shagreened, shiny; clypeus wrinkled and depressed in several places, principally along the upper part of the sutures; labrum wrinkled. Color, orange-brown to almost mahogany red; ocelli black, antennae and palpi ringed with black and white, their bases red; mandibles black, white inwardly; maxillae black. A few hairs sparsely distributed. Width 5.3 mm. Cervical shield, anal plate, bases of all the legs, and corresponding on the apodous segments (i.e. on the first, second, seventh and eighth, but *not* on the ninth, abdominal segments) mahogany red, the thoracic feet black, the abdominal orange brown, in some examples a little blackish outwardly. Body black, the ventral lines absent or represented by a few elongated dots, the lateral bands broken into rows of sub-quadrate spots, as I have elsewhere described.* This "serial atrophy" occurs in the following manner: — the three upper lateral stripes on each side are broken in each segmental suture and more or less broadly through the centre of the segment, the third lateral band (superstigmatal) less broadly than the others. The fourth lateral (substigmatal), the subventral, interrupted by the bases of the legs, and the central ventral (these last two are represented only by dots) are broken twice on each segment, once just before the spiracles and again toward the posterior edge of the segment, but are not broken in the sutures. In some examples, the posterior white spot of the third lateral band is again narrowly broken, and the bisegmental spot of the fourth row very narrowly in the sutures. The stigmatal spot of this row, when large, is apt to be broken at the spiracles. On the prothoracic segment, the two upper bands are represented by a white dot behind the cervical shield; the third, by a rectangular spot above the spiracle; the fourth by the bisegmental spot. On the ninth abdominal segment, the first row has a sub-quadrate spot, in some, followed by a dot; the second, a rectangular spot scarcely bisected, the third and fourth are normal. The tenth abdominal has only a dot representing the third lateral band, and the bisegmental spot representing the fourth. The subventral lines are represented by dots between each segment from the third to the eighth abdominal, and the ventral, by the bisegmental dots and a dot anterior to the bases of the legs on the second to the sixth abdominal segments.

* Can. ent., v. 21., p. 34.

Spiracles velvety black. Hair white, rather long, beside numerous fine, short black hairs, all growing from minute black tubercles. Length of larva at maturity 60 mm. The form of this larva with canary yellow bands and spots did not occur in any of the examples from which these notes were made (a brood of 55 and another large brood observed in the field). I have formerly found a few yellow ones among a brood of white spotted *D. major*, and occasionally a brood entirely yellow. Though the difference in coloration is very marked between the two forms, it is evidently, from its mode of occurrence, only a variation. A similar variation occurs in *D. palmii* * and less markedly in *D. contracta*.

*Pupa.* Formed in a subterraneous cell. In shape it is robust, cylindrical, thickest centrally, and rounded to the head; cases distinct; a slight creased elevation between the eyes. Abdominal segments slightly tapering; cremasters, two, very short, not well separated, each with three spines, the posterior one the longest, but often two, or partly aborted. Cases creased, body coarsely punctured, very finely in the movable sutures. Color dark or blackish mahogany. Length 25 mm., width 9 mm. This stage lasts through the winter and the species is single brooded. The duration of the larval stages was as follows: — 1st stage, not observed, but probably about five days; 2nd stage, 6 days; 3rd stage, 8 days; 4th stage, 9 days.

FOOD-PLANT: *Andromeda ligustrina.*

Larvæ from Ulster Co., N. Y.

DATANA DREXELII, *Hy. Edw.*

*Egg.* On the type of *D. ministra.* Subcylindrical, of a little greater diameter near the bottom than near the top; vertex rounded; base nearly flat. Color shiny whitish, the circular lid-like top very white and shiny, with a central small round black spot. Diameter .7 mm. In hatching, the larva eats away the lid, and emerges from the hole thus formed.

*First stage.* Head rounded, black, shiny; width .5 mm. When newly hatched, the larva is scarcely distinguishable from *D. major.* The anal feet are rather long and elevated. Body sordid yellow, cervical shield, anal plate and feet, blackish. A number of short hairs from the head and from about six rows of small blackish tubercles which are larger in proportion than in the subsequent stages. As the stage advances, the body becomes reddish with four lateral stripes on each side and three ventral, about as wide as the intervening spaces, dull yellow and confluent posteriorly. During this stage, the larvae eat the parenchyma in the same manner as *D. major.* I have estimated that a single larva eats about 90 sq. mm. of Witch-Hazel leaf.

*Second stage.* Head black and shiny with a few hairs, width 1.1 mm. Body brown, stripes dull yellow, narrower than the intervening spaces, extending

* I would like to call attention to the relationship that evidently exists between *D. palmii* and *D. major.* They are alike in egg structure, in the feature of bicolorous larval hairs (which does not occur in any other species to my knowledge), in coloration of head and lines and in the slightly scalloped forewings of the moth.

from the cervical shield and the anterior edge of the prothoracic segment to the anal plate and becoming a little confluent there. Cervical shield, anal plate, thoracic and anal feet and the abdominal feet outwardly black. Hair short and pale. During this stage, the larvae eat the whole leaf.

*Third stage.* Head higher than wide, depressed at the sutures of the clypeus; smooth shiny black, width 1.8 mm. Body brown, the stripes yellow, confluent posteriorly and along the anterior edge of the prothoracic segment. Otherwise as in the previous stage.

*Fourth stage.* Head shaped as before, smooth; centrally depressed at the top of the clypeus and more slightly along the central suture; clypeus and labrum wrinkled; all shining black; width 3.2 mm. Cervical shield black or partly brown, in some examples nearly all light brown; anal plate, thoracic feet and the abdominal feet outwardly, black. Body black or partly brown, the anterior half of the prothoracic segment yellow, the stripes strongly confluent on the last segment. The bases of the legs and corresponding spots on the legless segments, as in the mature larva, of a darker yellow than the lines. Each segment is shaded centrally with this yellow, but it does not cause the lines to appear confluent on account of its darker shade. Hair sordid white beside other short fine brownish hair seen with a lens.

*Fifth stage.* Head as high as wide, flattened in front, depressed at the upper part of the sutures of the clypeus, punctured. Clypeus and labrum somewhat wrinkled. Color shiny black, the antennae and palpi white-ringed, their bases greenish. Width 5.4 mm. Body black, cervical shield honey yellow, anal plate, thoracic and anal feet and the abdominal feet outwardly, black. Anterior half of the prothoracic segment yellow; stripes narrower than the spaces, citron yellow, running into the yellow part of the prothoracic segment and confluent posteriorly on the tenth abdominal, which is all yellow except the anal plate and a dorsal band. The three upper lateral lines are connected also on the eighth and ninth abdominal segments by a broad dark yellow shade. The bases of the legs and corresponding spots on the apodous segments (on the first, second, and seventh, eighth and ninth abdominal segments) also dark yellow, forming expansions of the subventral line and reaching the lowest lateral line, except on the thoracic segments and the ninth abdominal. On the apodous segments in the centre of each yellow patch, is a small black spot, representing the absent legs, but this is not present in all examples. Hair rather abundant, sordid white, the long and short hairs concolorous, arising from minute blackish tubercles which, in the black parts of the body, are each surrounded by a minute yellow ring.

*Pupa.* Exactly like that of *D. major*; the two cremasters each bear three spines in a transverse row, the posterior one the longest. Length 28 mm; width 10 mm.

Single brooded, the winter being passed in the pupa state beneath the

ground. The duration of the larval stages was as follows.— 1st stage, 5 days; 2nd stage, 6 days; 3rd stage, 6 days, 4th stage, 7 days; 5th stage, 7 days.

FOOD-PLANTS: *Hamamelis virginica, Vaccinium stamineum.*

Larvae from Ulster Co., N. Y.

## THE NUMBER OF MOLTS OF LEPIDOPTEROUS LARVAE.

BY HARRISON G. DYAR, RHINEBECK, N. Y.

Two articles have already appeared in PSYCHE on this subject * and it is evident from a perusal of them that considerable confusion exists as to the number of molts of certain species. In this article I propose to establish a criterion by which different observations may be compared and errors detected, for it is no difficult thing to overlook a molt or even to think one has occurred when it has not.

It will be seen by an examination of the following figures that the widths of the head of a larva in its successive stages follow a regular geometrical progression, and if, in examining the measurements of heads taken in following out a life history, any deviation from the calculated progression is shown, it is evidence that an error has been committed or that the larva has behaved in an abnormal manner; but the latter case can readily be distinguished from the former if a moderate degree of care has been exercised in taking the measurements. Hence, if two sets of observations show a different number of stages for the same insect but each follows its own progression, we may conclude that this variation is actual; but if either set shows a lack of regular progression that one we must regard with suspicion. Corroborative observations of the kind indicated are to be desired and until we have them we can not speak with confidence about the number of molts of any species. I recommend that all who hereafter describe larval stages give the width of the head for each stage. I have selected the *head* as the part not subject to growth during the stage, and its *width* as the most convenient measurement to take.

In the following I give first the calculated widths of head under each species, with the ratio, followed by those that were actually found. All measurements are in millimeters and may be considered accurate to within .1 mm. Certain irregularities are commented upon in the notes to which the small numbers refer.

### FOUR STAGES.

*Callosamia promethea* Drury. calc. 1.1 1.6 2.3 3.3, r .70
found 1.0 1.7 2.3 3.3 [1]

* W. H. Edwards, Psyche, v. 3, p. 159.
A. K. Dimmock, Psyche, v. 5, p. 28.

FIVE STAGES.

*Papilio cresphontes* Cram. calc. .7 1.1 1.6 2.3 3.4, r .68
found .6 1.1 1.6 2.2 3.4

*Eudamus tityrus*, Fabr. calc. .6 1.0 1.7 2.8 4.7, r .60
found { .6 1.1 1.8 2.5[2] —
{ — — 1.7 3.2[3] 4.7

*Syntomeida epilais*, Walk. calc. .6 .8 1.1 1.5 2, r .73
found { .4?[4]. 91 + — —
{ — — — 1.5 2.0

*Datana drexelii* Hy. Edw. calc. .6 1.1 1.9 3.2 5.4, r .60
found .5 1.1 1.7–1.9 3.2 5.4

*Datana major* G. & R. calc. .6 1.0 1.8 3.1 5.3, r .58
found .5 1.1 1.7 3.1 5.3

*Datana palmii* Beut. calc. .5 .9 1.5 2.7 4.6, r .58.
found .5 .9 1.6 2.7 4.6

*Datana integerrima* G. & R. calc. .5 .9 1.6 2.6 4.3, r 60
found — .9 1.6 2.7 4.3.

*Datana perspicua* G. & R. calc .7 1.1 1.7 2.7 4.1, r .65
found .5 1.1 1.6–8 2.7 4.1

*Oedemasia concinna* A. & S. calc. .45 .7 1.1 1.75 2.7, r .65
found { .4 1.0[5] 1.3 — —
{ — — 1.1 1.7 2.7

*Schizura leptinoides* Grote calc. .5 .8 1.3 2.1 3.3, r .64
found .5 .8 1.5 2.1 3.3

*Schizura ipomeae* Doubl. calc. .6 .9 1.4 2.2 3.3, r .66
found — — 1.5. 2.2 3.3[6]

*Heterocampa subrotata* Harv. ♀ calc. .7 1.1 1.7 2.6 3.9, r.66
found .6 1.1 1.7 2.6 3.8

*Heterocampa unicolor* Pack. calc. .5 .8 1.3 2.0 3.2, r 64.
found .4 .7 1.35 2.1 3.2

*Platysamia cecropia* Linn. calc. 1.1 1.6 2.4 3.6 5.5, r .66
found { 1.3[7] 1.6 2.4 3.5 5.5
{ 1.1 — — — —

SIX STAGES.

*Euchaetes egle* Harr. calc. .45 .6 .9 1.3 1.9 2.7, r .70
found — .6 .9 1.3 2.0 2.7

*Edema albifrons* S. & A. calc. .4 .6 1.0 1.7 2.7 4.3, r .62
found { .4 .7 1.3 1.7 2.3 —[8]
{ .4 .7 1.3 1.7 2.2 3.2

*Dryopteris rosea* Walk. calc. .25 .4 .6 .9 1.3 2.1, r .66
found .3 .4 .6 9. 1.3 2.2

*Hyperchiria io* Fabr. calc. .8 1.1 1.7 2.4 3.5 5.1, r .69
found .8 1.2 1.7 2.6 3.4 5.1

*Clisiocampa americana* Har. calc. .4 .6 .9 1.3 2.0 3.0, r. .66
found { .4 .6 — — — —
{ — — .9 1.3 2.0 3.0

*Agrotis incivis* Guen. calc. .4 .6 .9 1.3 2.0 3.0, r .66
found .2[9] .7? .9 1.3 2.0 3.0

SEVEN STAGES.

*Halisidota harrisii* Walsh. calc. .4 .6 .8 1.2 1.7 2.4 3.5, r .70
found { .4 .6 .9 1.4 1.6 2.3 3.5
{ .4 .6 — 1.3 1.7 2.6 3.6

*Hyphantria cunea* Drury. calc. .3 .4 .6 .8 1.2 1.7 2.4, r .70
found { .3 .4 .6 .81 .2 1.4[10] —
{ — — — — — — 2.4

*Orgyia definita* Pack. ♀ calc. .5 .7 1.0 1.4 2.0 2.8 4.0, r .70
found — .7 1.0 1.5 2.1 2.8 3.5[11]

EIGHT STAGES.

*Scepsis edwardsii* Grote. calc. .3 .4 .6

.9 1.2 1.6 2.2 3.0, r .73

found { .4 .5 .7 .9 .1.2 1.6 — —. / — — — .9 1.2 1.6 2.3 3.0 }

NINE STAGES.

*Halisidota caryae* Harr. calc. .5 .7 .9 1.2 1.6 2.0 2.6 3.4 4.3, r .78

found .4 .6 —[12] 1.2 1.5 2.1 2.7 3.4 4.4

*Halisidota tesselaris* S. & A. calc. .5 .7 .9 1.2 1.6 2.0 2.6 3.4 4.3, r. 78

found { — — — 1.3 1.7 —[12] 2.7 3.5 4.3 / .4 .6 .9 — 1.6 2.1 2.6 — —. }

TEN STAGES.

*Pyrrharctia isabella* A. & S. calc. .4 .5 .7 .9 1.1 1.6 2.0 2.6 3.2 4.1, r .79

found .4 .5 .7 .9 1.2 1.6 2.2 2.6 3.6[13] 4.1

NOTES.

[1] It will be seen that I corroborate the observations of Mr. W. H. Edwards in giving four stages to this species, and as my specimens were bred in Rhinebeck, N. Y. the theory of variation in the number of molts due to climatic influence suggested by Mrs. Dimmock (Psyche, v. 5. p. 29) does not appear to be sustained.

[2] This measurement, 2.5 mm., is too small as the larva was unable to cast its skin and the head was dwarfed.

[3] This is too large; it is possibly an error of observation and was not verified.

[4] An incorrect measurement. I find it marked with an (?) in my notes.

[5] A remarkable instance of excessive development. I do not think any error was made. The second example behaved in a normal manner as can be seen from what measurements I have.

[6] My observations do not agree with those of Dr. Packard on this species, who finds six stages. (Proc. Bost. soc. nat. hist. v. 24, p. 534.)

[7] The second example has the normal measurement. Possibly I have made an error in the first measurement.

[8] It will be seen that in both examples no series is followed, but both larvae became unhealthy and died in the fifth and sixth stages respectively which probably accounts for the dwarfed dimensions of their heads. This is one of the instances of abnormal development which is readily distinguishable from an error of omission.

For examples of the latter see note ([12]).

In giving six stages to this species I corroborate the observations of Mr. Beutenmüller (Ent. Amer., v. 6, p. 75) but disagree with Dr. Packard who finds but five stages. (Proc. Bost. soc. nat. hist., v. 24, p. 525.)

[9] An erroneous measurement. It is marked in my notes as carelessly taken.

[10] This larva died in the sixth stage and its head is seen to have been dwarfed.

[11] The last stage, width of head 3.5 mm., occurs only in larvae that produce female moths and it is seen to be too small for the series. I intend to make more observations on this species and will not comment on it further at this time.

[12] Examples of accidental omissions which were not detected at the time and which would have gone entirely unrecognized had it not been for the measurements recorded. On making calculations and observing the apparent omissions I endeavored to obtain more larvae. No young *caryae* were to be had, but some *tesselaris*, carefully watched exhibited the missing stage as may be seen from the second example.

[13] Probably an error. I found this larva very difficult to measure and this particular stage was not verified by measuring the cast head as most of the others were.

# DESCRIPTIONS OF NEW WEST AFRICAN LYCAENIDAE.

BY W. J. HOLLAND, PITTSBURG, PA.

The insects described in the following pages were all taken upon the upper waters of the River Ogove in the French Territory of Gaboon. They were collected by my friend, Rev. A. C. Good, during his stay there, which terminated in the spring of the year 1889. It is my intention as soon as possible to publish figures of all of these species.

## EULIPHYRA, gen. nov.

1. E. MIRIFICA, sp. nov.

Antennae short; palpi minute, compressed; body robust; anterior wings subtriangular, with the costa strongly arched, the apex truncate. beneath which the outer margin is excavated and concave; the inner margin is more or less sinuate. The posterior wings are subovate, strongly produced at the anal angle and scalloped on the lower third of the outer margin. The color of the upper surface of the wings is uniformly a dull black except that upon the inner margin of the primaries, about half-way between the base and the outer angle, there is a large subquadrate spot of pure white. The color of the under side of the primaries is fuscous shading at the apex into a lavender gray. There is a patch of sooty upon the costal margin and the upper part of the cell midway between the base and the apex. The white spot of the upper surface reappears upon the under side. The secondaries are lavender gray shading toward the outer margin into pale fuscous and ornamented by a number of very irregular dark maroon-colored lines and spots, which enclose at the end of the cell a large patch of silvery scales. Expanse of wings, 53 mm.

The specimen was developed from "a very singular chrysalis, short and thick, and unlike anything of the kind I have observed before, which was found upon the under side of a large leaf. It was black in color." (A. C. Good.)

Type ♂ in collection of Rev. W. J. Holland.

This insect is closely allied in some respects to *Liphyra leucyania*, Hew. Neither of them are truly referable to the genus *Liphyra* and I propose for their reception a new generic name *Euliphyra*.

## EPITOLA, Westw.

2. E. SUBFULVIDA. sp. nov.

Upper side of head, antennae, palpi, and thorax dark brown; abdomen fulvous. Anterior wing strongly arched near the base, abruptly truncate at the apex, and slightly convex at the middle of the external margin; the posterior wing is subovate, with the outer margin evenly rounded; the inner margin is deeply excavated at the anal angle. The color of the anterior wing is deep cadmium yellow, with the costal margin and the outer margin broadly dark brown. A black spot, fusing with the dark brown costal margin, is located at the end of the cell. The posterior wings are of the same color as the anterior,

but the dark brown border is much wider and the cadmium yellow area is confined to a small space about the region of the cell. The inner margin, forming a groove in which the body is partly enclosed, is light yellow.

The undersurface of both wings is uniformly cadmium yellow. Under surface of the body, legs, and undersurface of the palpi of the same color. Expanse 33 mm.

Type ♀ in collection of Rev. W. J. Holland.

It is with the greatest hesitation that I refer this species to the genus *Epitola* It will with the following species probably constitute a new genus.

3. E. PURPURASCENS, sp. nov.

The description of the form of the wings of the preceding is also applicable to the present species. The prevalent color of the upper surface of both wings is a purplish gray of a very delicate cast. The cell of the primaries and a streak beyond it just below the costal margin are black. Just beyond the end of the cell the ground color of the wing fades into a pale blue, and the base of the wing is powdered with greenish scales. The outer margin is lightly shaded with brown. The posterior wings are uniformly of the ground color, save at the base, where they are powdered with greenish scales, and on the outer margin, where they are more narrowly brown than the primaries. The underside of both the primaries and the secondaries are lavender gray. Just before the apex of the primaries a narrow band of dark brown scales takes its rise upon the costa and is extended obliquely across the wing and continued upon the secondaries to the anal angle. The whole surface of both wings is further mottled with minute spots of dark brown, which under the microscope are seen to be composed of from three to five dark-colored scales. Expanse of wings 42 mm.

Type ♀ in collection of Rev. W. J. Holland.

4. E. GOODII, sp. nov.

Upper surface of both primaries and secondaries morpho-blue. The costa of the primaries from the base and the apical half of the wing are broadly black. The blue cuts into the broad black area of the wing near the end of the cell. The margin of the secondaries is very narrowly black except at the outer angle which is somewhat broadly fuscous.

The under surface of both wings is chalky white, traversed by a number of irregular bands of faint brown. There is a very narrow marginal black line. Expanse of wings 44 mm.

Type ♂ in collection of the author.

5. E. CERCENOIDES, sp. nov.

The prevalent color of the upper surface of both wings is a very intense lapis lazuli, showing in certain lights a beautiful greenish iridescence. The costal margin of the primaries is narrowly and the apical third broadly black. At the end of the cell there is a somewhat curved triangular spot of the same color, and the median and submedian nerves are covered with black scales toward the base. The anterior margin of the secondaries is broadly, and the external margin very narrowly black. The fringe of the primaries just before the outer angle, and the fringe of the secondaries just behind the outer angle is narrowly white. The underside of both wings is dark plumbeous, ornamented with numerous transverse bands of waved lines and sagittate spots of a pale blue color, of which those at the outer angle of the primaries are the broadest. Expanse of wings 36 mm.

Type ♂ in collection of the author.

6. E. BENITENSIS. sp. nov.

The costal margin of the primaries of this small and well marked species is very strongly arched and the apex is more acute than in any other species of which the writer has knowledge. The color of the upperside of the anterior wings is black, ornamented with blue spots, of which one, very small, is situated on the middle of the cell, and another of the same size, just beyond the cell; while five are disposed in the form of a transverse submarginal series which is interrupted between the second and third median nervules, and in which the spots increase in size toward the posterior margin. The base of the wing and the costa are powdered with a few scattering blue scales. The posterior wing is morpho-blue with the anterior and outer margins and the median nerve and nervules broadly black. The inner margin is gray. The prevalent color of the under surface of both wings is a dark wood brown. The discal area of the primaries is suffused with blackish. The spots of the upper side reappear upon the under side as very faint bluish gray markings, the edges of which are rather sharper than upon the upper side. There is in addition a faint marginal band of lunules. The secondaries are ornamented with a similar faint marginal and submarginal band of lunules, and with three or four spots about the end of the cell. Head, thorax, and abdomen concolorous. Expanse of wings 30 mm.

Type ♂ in collection of the writer.

7. E. UMBRATILIS, sp. nov.

Allied to *E. marginata*, Kirby, but differing from this species in being of a paler blue upon the upper surface, and by not having the margin of the wings denticulated and the denticulations dusted with white. Upon the under side there are also marked differences. The general ground color is as in Kirby's species, but the irregular zig-zag markings are more numerous and more sharply defined than in *E. marginata*, and are disposed in well-marked transverse series giving the wing a somewhat banded appearance.

PHYTALA, Westw.

8. P. ELAIS, Doub, Hew. *Female*.

The female of this interesting species, so far as I am at present aware, has not hitherto been described. I have a specimen taken *in coitu* with a typical male. It is uniformly brown upon the upper side except upon the apical half of the primaries where the brown shades gradually shade into deep velvety black, which is interrupted beyond the end of the cell by a broad subapical band of yellow which extends from the costa to the third median nervule, and is constricted at the upper radial. The under side is not materially different in markings from the male, except that the yellow band faintly re-appears, and the general tone of the markings is lighter. Expanse of wings, 67 mm. The example was taken upon 5th Jan., 1887, at Kangwe.

PSEUDERESIA, Butl.

9. P. O-RUBRUM sp. nov.

This species is closely allied to *P. Catalina*, Kirby and Smith, but differs

in the almost entire absence of any red markings on both sides of the wings. My sole example is a female.

The upper side of the head, body and wings is uniformly dark brown. The under side is also dark brown, becoming paler at the base and the outer margins of both wings, which have a faint submarginal and marginal band of sagittate grayish spots disposed regularly upon the intra-neural spaces. Four vermilion spots are clustered about the end of the cell in the secondaries, and all of these except the one just beyond the end of the cell are pupilled with dark brown, giving them the appearance of the letter "O" in crimson. Expanse of wings 40 mm.

Type in author's collection.

10. P. LATRUNCULARIA, sp. nov.

Allied to *P. helena*, Druce, but differing in the following particulars:

1st. The *total absence of all crimson markings*,

2nd. *The spots of the under side*, which agree in the main in location with the spots of the under side of *P. helena*, as figured in Kirby & Smith (except that the red ones are wanting), are *not yellow* but brilliant white and larger, and more sharply defined. Otherwise the description of Mr. Druce holds good.

This may prove to be a local or seasonal form of *P. helena*.

Type ♂ in collection of the author.

11. P. DESPECTA, sp. nov.

♂. Upper surface uniformly dull purplish black. Under side dull blackish gray, darkest at the base of the primaries. Both the primaries and the secondaries are traversed by marginal, submarginal, and median bands of pale whitish sagittate marks. There are also upon the secondaries a number of obscure little markings in the region of the cell.

♀. The female is like the male except that the apex of the primaries is less acute and the outer margin more rounded, and the color of the upper surface is pale reddish brown.

Described from 5 ♂♂ and 2 ♀♀ in the author's collection.

SPALGIS, Moore.

12. S. S-SIGNATA, sp. nov.

♂. Upperside. Head, thorax, abdomen, and anterior wing upon the base, anterior margin, apex, and outer margin, black. The rest of the upper surface of the wings pure white, except that there is a very fine black marginal line surrounding the secondaries, and that the extremities of the nervules of these wings are marked with black points. Underside. The underside is white shading iuto a very pale gray upon the costal and outer margin of the primaries. This shade is due apparently to the black upon the upper surface. The anterior wing has a triplicate, and the posterior wing a geminate marginal line. These are followed toward the base by series of more or less broken and interrupted lines, more thickly distributed at the base than elsewhere. In the cell there are two annular spots, of which the outermost and largest has the appearance of the letter "S." The ends of the nervures are tipped with black. Expanse 34 mm.

♀. The female has the anterior wings with the apex less produced, and the outer margin more rounded. The outer margin of the secondaries is also broadly black like the margin of the anterior wings. The under-

side is white, all the narrow lines and markings which appear in the case of the male being obsolete except those about the outer margins of the wings. Expanse 30 mm.

Described from examples taken *in coitu*, and contained in the collection of the author.

It is with much hesitation that I refer this insect to Mr. Moore's genus *Spalgis*, but it comes nearer to it apparently than to any other of these erected by lepidopterists. It will probably become the representative of a new genus, when the future revision of the *lycaenidae* takes place.

### LACHNOCNEMA, Trim.

13. L. EXIGUUS, sp. nov.

Upperside. Head, thorax, abdomen and antennae black. Wings white with the costal and outer margins of the anteriors and the outer margin of the secondaries broadly black.

Underside. Legs white, and also the abdomen except at the tip where it is fuscous. Wings white with the costa of the primaries narrowly and the apical third broadly washed with pale wood brown. The outer margin of the secondaries is also broadly suffused with the same color. Near the apex of the primaries there is a submarginal row of three and a marginal row of five gilt spots. Near the anal angle of the secondaries there is a similar series of marginal and submarginal spots, and upon the anterior margin of the secondaries there are three elongated coppery gilt spots. Expanse 25 mm.

Type ♂ in collection of the author.

### LARINOPODA, Butler.

14. L. PERFRAGILIS, sp. nov.

Upper side. Antennae, head, thorax, and abdomen black. Wings pellucid, white. The costal and outer margins of the primaries are somewhat broadly and the outer margin of the secondaries very narrowly laved with black. There is a round black spot at the end of the cell of the secondaries.

Under side. Exactly as the upper. The legs are crimson. Expanse of wings 40 mm.

Type in coll. Holland.

15. L. CAMPIMUS, sp. nov.

Allied to *L. libyssa*, Hew., and closely resembling it upon the upper side. The broad black margin of the wings is however quite regular and not excavated on the costa at the end of the cell of the primaries, and just below the outer angle of the secondaries as in *L. libyssa*, and the markings of the under surface being different do not appear the same upon the upper surface which permits of their being seen on account of the partly diaphanous nature of the wings. Underside. Anterior wings white, with the costal and outer margins broadly black, the black being extended downward upon the cell in the form of a couple of teeth. At the apex the black area is interrupted by a lunate white spot and a narrow marginal line. The posterior wings are also white with the outer and inner margins broadly black. Just before the middle of the anterior margin a broad straight band of black arises and crosses the wing diagonally to the inner margin; a similar black band extending from near the outer angle of the wing runs parallel to and at a slight remove from the anterior margin and coalesces with the broad black diagonal band. The broad outer band of black is adorned near the outer angle by a large white spot which is followed toward the anal angle by several smaller spots of the same color. Expanse 28 mm.

Type ♂ in collection of the writer.

### D'URBANIA, Trim.

### 16. D. MONDO, sp. nov.

Upperside of head, antennae, and body dark brown. Ground color of both wings orange red. The base and costa of the anterior wing is covered with minute blackish striae and spots. The apex and outer margin are black. There are three black spots in the cell of which the outermost is the largest, and there are three connected and somewhat irregular spots which form a band running from the middle of the costa toward the outer margin with which they partly fuse. The outer margin of the secondaries is broadly dark brown, and the surface of the wing is very densely mottled with the little spots and striae described as appearing upon the primaries. This maculation is least dense upon the nervures, and the wing has thus a rayed appearance imparted to it. The underside of the anterior wing is lighter red than the upper; the base, costa, apex, and outer margin are gray irrorrated with minute black dots. The spots reappear as upon the upper surface, and in addition a large spot between the second and third median nervules. The underside of the secondaries is of the same gray color as the base of the primaries. There is a waved marginal line, an interrupted submarginal series of black spots arranged in two groups of three spots each; a transverse series of four spots extending across the wing, the spot nearest the inner margin being the smallest, and three spots at the base. These spots are not quite constant, and there are sometimes one or two more minute ones upon the wing. The female does not differ materially from the male. Expanse of wings ♂ 35 mm., ♀ 32. mm.

Described from four males and two females in author's collection.

### 17. D. OSHEBA, sp. nov,

Upperside of head and body black. Wings with their outer margins scalloped and the fringes narrowly gray between the extremities of the nervules. The anterior wing is broadly black, with a minute spot of crimson near the base and a larger spot of the same color on the posterior margin. The hind-wing is crimson bordered evenly with black. In some specimens the border is narrower on the inner margin. There are a number of small black spots at the base. The underside of the wings is brown with a plumbeous sheen. There are a few obscure dark marks at the base of both wings. The crimson spot at the posterior margin of the primaries reappears upon the lower side and is surmounted by a small spot of the same color. There are a few crimson spots at the base of the secondaries, and a curved band of crimson spots crosses the middle of the wing, which is darker in the region of this band than elsewhere. The female does not materially differ from the male except as that sex always differs in the genus by having the apex of the primaries less acute. Expanse of wings 27 mm.

Described from two males and two females in author's collection.

### 18. D. ASHIRA, sp. nov.

Allied to *D. libentina*, Hew. Upper surface of the wings uniformly black except at the anal angle of the secondaries where there is a large subovate crimson spot. The underside is marked very much as in *D. libentina* but the ground color is darker and the crimson spots smaller and differently shaped. Nothing but a good figure can convey the idea of these differences, and such a figure I hope soon to publish.

Type in collection of the author.

19. D. OLOMBO, sp. nov.

Ground color of the upper side of the wings tawny red. The costal and outer margin of the primaries broadly black, as also the outer margin of the secondaries. The inner matter of the latter and the base fuscous. The ground color of the underside of the primaries is pale reddish, palest at the posterior margin. The broad black border of the costa is broken near the middle by a line of the ground color which passes upwards to the edge of the costa. This is followed toward the apex by two narrow dashes of ochraceous, two submarginal bands of sagittate spots decreasing in size from the costal margin, and by a narrow marginal line. The ground color of the underside of the secondaries is ochraceous. The black border is interrupted by a narrow marginal line and the double band of sagittate spots like that on the primaries. Beyond this toward the base are from twelve to fourteen spots of black of which the one at the middle of the anterior margin which is subquadrate in form is the largest. The male and female are not unlike. Expanse of wings 35 to 39 mm.

Described from five examples in collection of the author.

TERIOMIMA, Kirby.

20. T. LEUCOSTOLA, sp. nov.

Allied to *T. tenera*, Kirby. The wings are white. The costal margin of the primaries is very narrowly and the apical third very broadly blackish gray, with the dark margin, however, terminating abruptly before reaching the inner angle. There is no black border upon the secondaries. The underside is uniformly creamy white, with a faint trace of a black marginal line near the apex of the primaries. Fringe very narrowly black checkered with white. Legs black. Expanse of wings 28 mm.

Described from four examples in collection of the author.

21. T. XANTHOSTOLA, sp. nov.

Allied to the preceding species. The ground color of the wings is pale luteous. The costa and the apical third are bordered with black as in the preceding species, but the inner margin of the black border is more evenly rounded than in *T. leucostola*, and reaches to the outer angle of the wing. The anal angle of the secondaries is slightly margined with grayish. Underneath there are no dark markings except faint traces of a marginal line here and there. The fringe is exceedingly narrow and dark brown checkered with pale gray. Legs dark brown. Expanse of wings 26 mm.

Described from numerous examples in the collection of the author.

22. T. XANTHIS, sp. nov.

Allied to *Pentila* (?) *evanescens*, Kirby. It differs in being smaller, darker yellow, without any blackish border on the primaries except at the tip, and no trace whatever of such a border upon the secondaries. The underside is immaculate and the only ornamentation consists of a faint submarginal band near the apex of the primaries, and three faint lines traversing the posterior wings parallel to the outer border upon the outer third. Expanse 27 mm.

Described from numerous examples in the collection of the author.

APHNAEUS, Hübn.

23. A. ILOGO sp. nov.

Allied to *A. orcas*, Drury. Upperside.

Front and a narrow line around the eyes white Antennae, head, thorax, and abdomen black. Primaries black, with the lower third of the wing almost to the outer margin densely covered with blue scales. There are besides three small blue spots on the cell near the base, and two at the end of the cell pupilled with white. Beyond these a few scattering blue scales. Secondaries black laved with blue upon the discal area. There are two small white spots at the point where the longest of the two tails joins the outer margin, and at the indentation of the inner margin just above the anal lobe there is a white spot. Underside. The ground color is deep cadmium orange. The fringes are black. The wings are ornamented with silvered spots bordered with black, and disposed as follows:— Upon the anterior wing, a round spot upon the cell near the base, followed by a figure 8 spot on the middle and a long spot at the end of the cell; beyond this near the costa three small spots closely clustered, below these a larger oval spot, and between the median nervules at their origin two small spots the border of the lower one of which fuses with the border surrounding the very large spot which covers almost the entire inner margin of the wing: there are six small submarginal spots, three near the apex, and three near the inner angle of the wing;—upon the posterior wing a small spot upon the costa at the base, a round spot in the cell and two oval spots which coalesce at the end and a small oval spot below the cell, beyond these a curved series of six spots, of which the third is very small and the last geminate situated below the first median nervule; upon the inner margin about the middle is a round spot succeeded by an oblique bar having at its outer extremity a small spot, this is succeeded by another shorter bar, at the end of which is a short curved series of three small spots. Just above the anal lobe there is a small triangular mark. The anal lobe is black, ornamented with two silvery blue spots. Tails black narrowly tipped with white. Underside of the palpi orange, legs and abdomen black ringed with white. Expanse of wings 36 mm.

Type ♂ in author's collection.

24 A. ARGENTEOLA sp. nov.

Allied to the preceding species. Upperside:— Antennae. head, thorax, and abdomen black. Wings brilliant greenish blue, with the costa and apical third of the primaries and costal and inner margins of the secondaries broadly black. Anal lobe black minutely spotted and margined with white. Tails black tipped with white. Underside:— Ground color rich maroon, shading upon the inner margin of the primaries into fuscous. The spots are located as in the preceding species but with certain marked differences. 1st, They are all smaller, more sharply defined, and less disposed to fuse. 2ndly, Upon the anterior wing the three clustered spots are succeeded by a long silvery bar extending outwardly toward the margin, instead of by an oval spot. 3rdly, The spots of the secondaries are more numerous and their disposition is slightly different. 4thly, The submarginal series of spots on both wings is composed of almost obsolete grayish points without any apparent trace of silvery pupillation in the specimens I have seen. Expanse of wings 23mm.

Type ♂ in author's collection.

25. A. CRUSTARIA, sp. nov.

Upperside:—Head and body black. Wings morpho-blue, the costa and apical third of the primaries and anal lobe of the secondaries black. Underside:—The ground color of the wings is pale stramineous. The fringes are very narrowly black checked with the ground color. There is a double marginal line of fuscous upon both wings. The spots are silvery copper bordered with reddish gray. Upon the primaries these spots are arranged

as transverse bars at right angles to the costal margin. Near the base of this wing below the cell there is a dark fuliginous mark. The spots upon the secondaries are crowded together toward the base and again toward the outer margin, leaving a clear discal band of the ground color visible. Three small round spots near the base and a quadrate bar in the outer series are conspicuous because showing no silvery pupillation and being darker in color than the rest. Anal lobe black. Palpi, legs and body concolorous. Expanse 27 mm.

Type ♂ in collection of the author.

26. A. ARGYROCYCLUS, sp. nov.

♀. Allied to *A. orcas*, Drury, but differing widely in important particulars from the female of that species.

Upperside:—The prevalent color is dark greenish brown glossing with blue in certain lights. There is a large white spot at the end of the cell of the primaries followed by a subapical series of very small and obscure spots. Underside:—The ground color is dark orange fading upon the inner margin of the primaries into pale testaceous. The fringes are black checked with white at the tips of the nervures. The anal lobe is black. The silvery spots adorning the wings are relatively large and ringed with dark maroon. Instead of the one long spot which stands upon the primaries of *A. orcas* the fourth from the base, there are in *A. argyrocyclus* three spots grouped triangularly. Instead of the nine silver spots which appear upon the secondaries of *A. orcas* there are in *A. argyrocyclus* sixteen spots and all lying within the submarginal band of dark maroon which in both species appears upon the secondaries. Expanse of wings 40 mm.

Type in collection of author.

*Pittsburg, Pa., 10 Nov. 1890.*

## SOME GENERA OF OEDIPODIDAE RESCUED FROM THE TRYXALIDAE.

BY SAMUEL HUBBARD SCUDDER, CAMBRIDGE, MASS.

In his Prodromus Oedipodiorum, Saussure constructs a table for the separation of the genera of this family, in which, when he has reached the "stirps Oedipoda," afterwards termed by him Oedipodites, he first separates from the remainder of the stirps the new genus *Daemonea*, an extraordinary form from Peru, known to him apparently only by a single imperfect and immature specimen in Brunner's collection. This genus he found to differ from all others in the forward extension of the vertex, "faciem adumbrans," the stout form of the hind femora with slight carinae, the great length of the hind tarsi which are nearly two thirds as long as the hind tibiae, and the peculiar concave structure of the dorsal surface of the pronotum.

In a recent study of some American species of *acridiodea* I have been greatly puzzled by a number of forms which seemed to lie on the border land between the *oedipodidae* and the *tryxalidae*. One by one they have been removed in my collection from one family and the other without finding a

resting place, until their comparative examination, after a general survey had been completed, showed me that they possessed features in common which warranted their being grouped together and placed as a whole in the *oedipodidae*, although several of them present marked Tryxaline features. I had concluded to regard them as a distinct subfamily of *oedipodidae*, when I dicovered that one of them, the genus *Hippacris*, described by me many years ago* from Peru as an exceptional form of *tryxalidae*, was very closely related indeed to Saussure's *Daemonea*, so much so that the latter genus also would have to be placed in the same category; this separate treatment, but under the name of a stirps, I believe *Daemonea* and *Hippacris* would have received at Saussure's hands, had he possessed a specimen of the latter; and to this assemblage of forms I propose to give the subfamily name of

### ACROLOPHITINAE.

The distinguishing characteristic of the members of this group among *oedipodidae* is that the front and vertex conspire to form an advancing process, sometimes also ascending, in the upper front of the head, much as in *Colpolopha* among *acrididae*, and in many *phymatidae*, and of course reminding us of *tryxalidae*; but in such other characteristics of structure as would be regarded as more commonly found in the *tryxalidae* than in the *oedipodidae*, they almost invariably incline to the latter group; and where any one of them shows a Tryxaline feature (besides the fronto-vertical process) in any marked degree, it is almost sure to be offset by some other more striking Oedipodine features and often by a combination of several. As a general rule, the face is almost perpendicular below the fronto-vertical process, which with the process causes the upper portion to be more or less concave. The eyes, except in *Peruvia* and especially in *Gymnes*, are remarkably small, generally very much shorter than the infraocular portion of the genae; the antennae are linear or faintly ensiform and usually depressed on the basal joints; the metazona is always somewhat though rarely much longer than the prozona, with the posterior process subrectangulate or broadly rounded, generally with a slight median carina running through the whole pronotum, but crested on the metazona in *Acrolophitus*, and almost absolutely absent in the genera at the other end of the series; the prozona traversed by a pair of faintly incised continuous transverse sulci, the hinder never confused with the typical sulcus separating the prozona and metazona; lateral lobes of the pronotum with the anterior and posterior margins parallel or subparallel, except in *Hippacris* (and *Daemonea?*); the mediastinal and scapular areas in the basal half of the tegmina more or less, sometimes very, irregularly reticulate, never with simple transverse parallel veins; the vena intercalata generally obscure, sometimes wanting, the vena axillaris sometimes free, sometimes impinging on the anal vein; metasternal lobes distant (except in *Peruvia*).

There is no doubt that *Hippacris* and *Daemonea* are widely separated from the others and that fully to justify their collocation in this manner intermediate types should be found; these are to be sought in the western tropics of America. It should not, however, be overlooked that in the form of the lateral lobes of the pronotum *Hippacri*

*Proc. Bost. soc. nat. hist., 1875, v. 17, p. 267.

and *Daemonea* are far more Tryxaline than any of the others, for the posterior margin rapidly retreats from the very tip, so that the lobe narrows perspicuously. The features in which these two genera stand apart from the others will be seen in the following table of the genera of this group, in which I have placed all known to me.

TABLE OF THE GENERA OF ACROLOPHITINAE.

Body slender; vertex horizontal or ascending at apex, the tip bluntly pointed; frontal costa extending to clypeus; metazona above transversely convex or tectiform or plane with a median carina, never concave; lower posterior angle of lateral lobes of prothorax subrectangulate; hind legs relatively long; hind femora slender, elongate and compressed; hind tibiae with more than eight spines in the outer row; hind tarsi less than half as long as hind tibiae.

Head as viewed laterally with distinctly ascending vertex; face below fronto-vertical process subperpendicular; metazona distinctly elevated above the prozona, tumid or crested; antennae more than half as long as the tegmina.

Metazona much longer than prozona, with an elevated crest. *Acrolophitus.*

Metazona barely longer than prozona, tumid, but with only a slight carina .... .............. *Acrocara.*

Head as viewed laterally with vertex scarcely or not ascending; face below fronto-vertical process distinctly though not greatly declivent; metazona hardly or not elevated above the prozona, rarely tumid, never more than gently carinate; antennae less than half as long as the tegmina.

Antennae much longer than the face; lower margin of lateral lobes of prothorax anteriorly excised, broadly exposing the pleural plate.

Antennae entirely filiform; dorsum of metazona raised at an exceedingly small angle with that of the prozona; anterior margin of tegmina shouldered but not distinctly lobed near the base; last hind tarsal joint hardly more than half as long as the other two together. *Pedioscirtetes.*

Antennae with the joints of the basal third depressed and slightly broader than beyond; dorsum of prozona and metazona in same plane: anterior margin of tegmina distinctly lobed near the base; last hind tarsal joint (at least in *Machaerocera*) longer than the other two joints together.

Fastigium of vertex longitudinally sulcate with no median carina; median carina of pronotum subobsolete between the sulci of the prozona; posterior margin of lateral lobes not produced posteriorly at its extremity; axillary vein of tegmina free; ulnar vein normal. *Machaerocera.*

Fastigium of vertex transversely tumid with a distinct median carina in addition; median carina of pronotum equally distinct throughout; posterior margin of lateral lobes produced posteriorly at the extremity into a slight rounded lobe; axillary vein of tegmina impinging on the anal at the end of the basal third of the wing; ulnar vein approaching the median...*Peruvia.*

Antennae shorter than the face; lower margin of lateral lobes of prothorax

nearly horizontal throughout, scarcely permitting the pleural plate to be seen. *Gymnes.*

Body very stout; vertex slightly descending at apex, the tip truncate; frontal costa not extending over the lower half of the face; metazona above transversely concave; lower posterior angle of lateral lobes of prothorax decidedly obtusangulate; hind legs relatively short; hind femora short and stout; hind tibiae with not more than eight spines in the outer row; hind tarsi more than half as long as hind tibiae.

Vertex gently convex between the eyes; transverse sulci of pronotum faintly traced except at the lateral canthi and there not deep, each subordinate lobe at this point armed with a rounded tubercle.......... ...............*Hippacris.*

Vertex transversely sulcate between the eyes; transverse sulci of the pronotum distinct, cutting deeply through the sharp lateral canthi................*Daemonea.*

From one of the early explorations next the eastern base of the Rocky Mountains under Major Long, Say was able to bring home many curious insects which for a long time were known only by his descriptions. One of these was his *Gryllus hirtipes* taken "on the banks of the Arkansaw River, about a hundred and fifty miles from the mountains." This striking and beautifully marked insect is still a rarity, and was not mentioned from the time of Say's description in 1825 until 1871 when Thomas in one of Hayden's Reports established for it the genus *Acrolophitus*, but left us at a loss as to its position, as he placed it with *Tomonotus* Sauss., an Oedipodid, between *Stauronotus* and *Stenobothrus*, the last two being well known *tryxalidae*; two years later however, in his Synopsis of the Acrididae he plainly refers it to a "section" containing only *tryxalidae*. No one has since disturbed it. It can hardly have been known to Saussure, the latest monographer of the *oedipodidae*.

As stated above however it is plainly one of the *oedipodidae*, for although the vertex is ascending and prominent, forming a distinct frontal process which makes it present a very curious aspect among *oedipodidae*, while the vena intercalata of the tegmina is feeble and irregular or wanting, yet its other characteristics are all of another kind. The front is subperpendicular, except for the slightly projecting process above; the eyes are very small and not more than half as long as the infraocular portion of the genae; the antennae are linear; the pronotum is crested (but on the metazona only), the metazona much longer than the prozona, rectangulate behind; the transverse sulci of the prozona are continuous and intersect the slight median carina; the anterior and posterior margins of the lateral lobes are subparallel; the basal half of the marginal area of the tegmina is irregularly and rather densely reticulate; the anal and axillary veins are independent; and the lobes of the metasternum are rather widely distant. Except for the fronto-vertical process the aspect is wholly Oedipodine. The structural features mentioned by Thomas being an insufficient characterization of this curious genus, the following description may here find a place.

## ACROLOPHITUS Thomas.

Body moderately slender. Head moderately large, slightly enlarging below, giving greater effect to the subconical ascending and advancing process, which is nearly as long as the eye and is formed of the extension of the front and vertex; the latter attenuate in front, forming slightly less than a right angle with the upper part of the frontal costa, the angle minutely rounded; frontal costa slender, the sides faintly converging from below upward, above the median ocellus more rapidly convergent and at extreme summit pinched to a lamina, below it sulcate, the lateral carinae of the face conspicuous throughout; fastigia obsolescent but not confounded with the vertex, their position at the convex base of the lateral ridge of the frontal process being clear but not sharply defined, the fastigia being in no way depressed, not visible from above. Lateral ocelli far removed from the margin of the vertex, close to the eyes. Eyes small, feebly prominent, not more than half as long as the infraocular portion of the genae. Antennae half as long again as head and prothorax together, nearly as long as the hind femora, rather coarse, the first joint nearly twice as long as broad, but little stouter than the succeeding, the joints of the apical half or more punctate.

Prothorax with the prozona quadrate with parallel sides, the dorsum depressed but transversely and gently arched, the metazona tapering slightly forward, the dorsum tectiform and strongly crested,—this with the elevated head giving it a strong selliform aspect; prozona with the median carina very obscure, distinctly intersected not only by the typical sulcus (which is thrust forward by the metazonal crest) but also by two additional sulci, between which the carina is entirely obliterated; metazona strongly and roundly crested, the hind margin rectangulate, the lateral carinae distinctly intersected by the typical sulcus, which extends normally into the lateral lobes; these have the posterior angle rectangulate, the lower margin obtusely angular, its hinder portion horizontal, its anterior obliquely ascending; metasternal lobes in ♂ nearly, in ♀ fully, as far apart as the mesosternal, both quadrate or transversely quadrate. Tegmina almost uniformly coriaceous throughout but feebly membranaceous apically, moderately slender, rather densely reticulate, supplied normally with spurious veins, the vena intercalata vague or lacking, the vena media and vena discoidalis both furcate, the vena axillaris independent. Radiate veins of anal field of wings normal, not incrassate. Hind femora slender, longer than the abdomen; spurs of hind tibiae strong, curved, arcuate, of considerable length but the inner scarcely two thirds as long as the first joint of the tarsi, which are of normal length.

These characteristics, apart from the pointed head, seem to show the nearest relation to *Leptoternis*, *Conipoda* and allied genera of the Old World; but *Acrolophitus* is still far removed from them, and though not so extraordinary a form as Saussure's *Daemonea* from South America, certainly shows many features which recall that strange type, and forms one link in a series connecting the typical *oedipodinae* therewith.

I know of but one species of the genus, *A. hirtipes*, first found by Say on the upper Arkansas and since reported from near Cañon City, Colorado, and Fort D. A. Russell, Wyoming (Thomas), and southern Colorado (Carpenter), and taken in Colorado 5000′ (Morrison), between Lakin, Western Kansas, and Pueblo, Col., July 8–9, 1877 (Scudder), at Pueblo, Col., July 8–9 and August 30–31, 1877 (Scudder), Meridian Creek, Tex., June 6, "very rare, found among bushes" (Belfrage), and

Pecos River, Tex. (Capt. Pope). Mr. P. R. Uhler has also given me specimens from Kansas and Texas. It seems to have been oftenest taken near its first known locality, on the upper Arkansas, east of the mountains.

The next genus mentioned in the table is closely allied to the preceding, but departs in a greater degree from the Oedipodine type. Except for lacking a metazonal crest on the pronotum, it bears indeed a striking resemblance to *Acrolophitus*, a resemblance which is most marked in the strange form of the head in both. The points, however, in which it further departs from the normal Oedipodine type are not many and may be summed up as follows: The prozona and metazona are of equal length, the latter obtusely and roundly angulate behind, the angulation scarcely perceptible; the basal third or fourth of the marginal area of the tegmina is reticulate indeed, but the reticulation is sometimes mostly made up of crowded transverse veinlets interlinked by inosculating longitudinal veins; and the axillary vein unites with the anal by the end of the basal fourth of the wing, much as in *Tropidolophus*. It does not appear to have been described, and may be characterized as follows.

ACROCARA (ἄκρος, κάρα) gen. nov.

Body slender, subfusiform. Head of the same general form as in *Acrolophitus*, but somewhat more slender and with the fronto-vertical process sometimes somewhat more advanced; the vertex attenuate and conical in front, slightly declivent at extreme tip, forming in general considerably less than a right angle with the upper, gently convex portion of the frontal costa; its upper surface is plane or plano-convex; frontal costa very similar to that of *Acrolophitus* but not so strongly compressed above the ocellus and compressed more uniformly and over a broader area, allowing the median sulcus to extend to the vertex though as slender as possible in the compressed portion; its sides are also less regularly convergent, being either disturbed by a rounded divergence, just above the extreme base, which just fails of reaching the clypeus or else parallel below; lateral carinae of the face moderate, straight, divergent; fastigia and lateral ocelli as in *Acrolophitus*. Eyes small, not very prominent, a little longer then half the infraocular portion of the genae. Antennae twice as long as the head and thorax together, longer than the hind femora, moderately coarse, the first joint as in *Acrolophitus*, the succeeding joints cylindrical and equal and the joints of the apical two thirds punctate (♂), or a little more than half as long again as head and thorax together, shorter than the hind femora, the joints beyond the basal sometimes depressed and then tapering to the apex (♀).

Prothorax with the prozona subquadrate with parallel sides, the dorsum not depressed but regularly arched transversely, in the ♀ with a slight tendency to be tectiform, the metazona tapering strongly forward and slightly tumid, the dorsum depressed but slightly tumid, this tumidity with the elevated head giving the whole a somewhat selliform aspect; prozona with the median carina subobsolete, distinctly intersected not only by the exactly transverse, typical sulcus, but also by two additional sulci, between which the carina is sometimes entirely obliterated; metazona with a distinct but slight and uniform median carina fading at the extremities, the hind margin obtusely and roundly angulate, the lateral carinae distinctly intersected by the typical sulcus which extends normally into the lateral lobes;

these have the posterior lower angle rectangulate, the extreme angle rounded, the lower margin barely angulate, the hinder portion subhorizontal, its anterior slightly ascending; metasternal lobes in ♂ about three fourths as far apart as the mesosternal; in the ♀ as far apart, subquadrate with convex sides. Tegmina slender, coriaceous throughout, but nowhere densely and less densely apically, rather densely reticulate on the basal half, normally supplied with spurious veins, the vena intercalata rather feeble and irregular but present, the vena media and vena discoidalis both furcate, the vena axillaris impinging on the vena analis. Radiate veins of anal field of wings normal, not incrassate. Hind femora slender, longer (♂), or slightly shorter (♀), than the abdomen; spurs of hind tibiae as in *Acrolophitus*; hind tarsi of normal length.

It will be seen from these details, that, notwithstanding the different character of the dorsal portion of the metazona the close relationship of *Acrocara* and *Acrolophitus* is clear. Two specimens are known to me, which may be separated as follows:—

Lateral margins of frontal costa convergent at base; fastigium of vertex as viewed above not projecting beyond the middle of the eyes by more than their distance apart at this point; middle half of wing occupied by a broad dark band.............*pulchellum*.

Lateral margins of frontal costa convergent at base; fastigium of vertex as viewed above projecting beyond the middle of the eyes by considerably more than their distance apart at this point; almost the entire wing dark...................*maculipenne*.

Bruner's *Pedioscirtetes pulchella* (Proc. U. S. nat. mus., 1890, v. 12, 60-61, pl. 1, fig. 10) of which he has considerately sent me the female type for examination, belongs in this genus; the other species has not before been described.

ACROCARA MACULIPENNE.

*Pedioscirtetes maculipennis* Bruner, Ms.

Dull brownish olive green; head, thorax, and legs sparsely and thinly pilose. Head dull shining silvery white with a faint greenish tinge; two obliquely vertical pale green bands pass downward and more or less backward from below the eye and from the posterior margin of the same, the former fading and dispersed below; vertex with a similar broad median band, merging into dark brown anteriorly; frontal carina luteous, the sulcus infumated below and more or less greenish. Antennae blackish brown, the apical and basal joints and the inner side of the impunctate joints reddish luteous. Prothorax with the dorsum olivaceo-fuscous, both front and hind margins and lateral carinae rather broadly ferrugineo-testaceous, the latter sometimes becoming pallid on the prozona; lateral lobes with varying shades of brown and olivaceous, the whole margin testaceous, the prozona with inferior and median pallid longitudinal stripes of varying width. Tegmina mottled with light and dark brown, the former prevailing on the basal, the latter on the apical half, arranged on the basal half in transverse, irregular, on the apical half in subparallel, oblique blotches and bars. Wings blackish fuliginous with a slight olivaceous tint, glistening and with purplish reflections, the extreme base like the basal half of the dorsum of the abdomen bronze green, the extreme tip narrowly margined with sordid white, the veins everywhere black and in the anal area narrowly margined with pallid. Hind femora with two strongly oblique, rather broad pale bars; hind femora dull luteous, obscurely banded with fuscous in the middle, next the base, and at the apex, the apical half of the spines black. Other legs obscure

fuscous, often with a greenish tinge, with the basal half of the femora paler.

Length of body (♂) 27.5 mm., (♀) 35 mm.; tip of head to tip of closed tegmina 36 mm.; of tegmina (♂) 27 mm., (♀) 29 mm; of hind femora (♂) 16.5 mm., (♀) 18 mm.; of antennae (♂) 21 mm., (♀) 15 mm.

Two ♂. Montelovez, Cohahuila, Mexico, September 20 (E. Palmer); one ♀, Lerdo, Mexico, November (L. Bruner).

The succeeding genus has a still more Tryxaline appearance, due principally to its more oblique face, which shows on a side view but little concavity below the fronto-vertical process. Whether it belongs in the *tryxalidae* or not, its close alliance to the preceding forms cannot be doubted. It has already been described, but insufficiently, by Thomas, who placed it with the *tryxalidae*, and it is here recharacterized.

### PEDIOSCIRTETES Thomas.

Thomas wrote the name *Pedioscertetes*, but this is incorrect, as it is plainly derived from σκιρταω.

Body slender, feebly fusiform. Head of the same general form as in *Acrocara*, but with the vertex nearly horizontal, the process barely ascendant, the process separated from the vertex by a distinct but not deep transverse arcuate sulcation striking the anterior border of the eyes; the vertex is gently convex transversely, the process slightly tumid above; frontal costa much as in *Acrocara*, but with a shallower sulcus which terminates above where the costa, over a brief space, becomes compressed to a thick lamina, and with a broader and more regular divergence at base; lateral carinae as in *Acrocara*, as also the fastigia and lateral ocelli. Eyes small, not very prominent, about two thirds as long as the infraocular portion of the genae. Antennae (now broken in the only specimen seen) said by Thomas to extend "about one fourth their length beyond the pronotum," linear, and cylindrical except that six or seven joints beyond the second are slightly depressed and shorter than the succeeding punctate joints without gaining noticeably in breadth.

Pronotum tapering gently forward, more conspicuously on the metazona than on the prozona, the former very slightly ascending posteriorly, the dorsum of the prozona broadly convex transversely, that of the metazona nearly plane; median carina slight, slightest on the prozona, subobsolete between the sulci of the same, the two sulci of the prozona faint but complete; hind margin of metazona very obtusely angulate, the angle rounded, the lateral carinae much as in *Acrocara*; lateral lobes much as there with the anterior border slightly sinuate; metasternal lobes almost as far apart in the ♀ as the mesosternal. Termina slender, subcoriaceous on basal third only, where they are densely reticulate, normally supplied with spurious veins, the vena intercalata only indicated in the middle of its normal course, the vena media and vena discoidalis both furcate, the vena axillaris impinging on the vena analis. Radiate veins of wings normal. Hind femora longer than the abdomen; spurs and hind tarsi as in *Acrocara*.

Only a single species is known, *P. nevadensis* Thom., from Nevada, one of the type-specimens of which has been obligingly sent me for examination by Dr. Riley. The wing is not well described by Thomas, nor well figured by Glover, and in the specimen seen is not fully spread, so as to render a good description impossible in its present condition. It may be said, however, that the band is fusco-fuliginous, broader

than figured by Glover, becomes obscure and paler toward the costal margin, where it is traversed by pallid cross-veins, and has the interior margin at this point limited by the divarication of the discoidal vein.

The fourth genus, *Machaerocera* Saussure, is a common form in Mexico, and need not detain us here. It shows no elevation of the metazona whatever.

The fifth genus of the table is founded upon a species from Peru, which I formerly described as a *Machaerocera*, but which must be separated from it, its distinctive features being shown in the previous table. It may be called

### PERUVIA gen. nov.

Body slender, subequal, compressed. Head moderately stout, trigonal. Vertex, including fastigium, gently and regularly convex, both longitudinally and transversely, with a distinct and equal median carina its entire length; triangular fastigium advanced in front of the eyes as far as their separation, the converging sides margined, the tip rounded; front considerably and almost uniformly declivent, faintly convex in front of the antennae, forming above a right angle with the vertex; frontal costa moderately broad, slightly expanding at the antennae, with subparallel sides, a little divergent below, with a broad and deep sulcus; lateral carinae prominent, parallel in upper half, considerably divergent in the lower; lateral ocelli next the eyes separated from them by their own width at the termination of the lower edge of the carinate margin of the fastigium of the vertex. Eyes semiglobular, prominent, equal, or perhaps a little more than equal, in width to the infraocular portion of the genae; beneath the middle of the eyes a short vertical carina which fades before reaching them. Antennae moderately slender, the six joints beyond the second depressed (beyond broken).

Prothorax compressed with parallel sides, the dorsum plano-subtectiform, with a strong subequal median carina throughout; prozona fully as long as the metazona, with parallel, slight, irregular, lateral carinae which are not far removed from the middle of either side; it is traversed by two straight transverse sulci which cut the carinae. but the anterior of which does not extend upon the lateral lobes, being supplanted by another in advance of it; metazona with scarcely more than shouldered lateral canthi. its posterior margin angulate at a little more than a right angle; lateral lobes with normal sulci, the anterior and posterior margins subparallel, the lower posterior angle rectangulate but with a slight posterior lobe, the lower margin horizontal in its posterior half and anterior fourth, the second fourth oblique exposing the pleural plate, which shows a small descending lobe at its anterior end. Metasternal lobes of female only a little more than half as distant as the mesosternal, marked inwardly by two profound pits. Tegmina moderately slender, the anterior margin with a distinct lobe at the end of the basal fourth, subcoriaceous throughout but nowhere closely reticulate except at the extreme base and on the costal and anal margins; no intercalary vein; ulnar vein approaching the median and widely separated from the posterior ulnar; median vein simple, axillary vein impinging on the anal. Wings with humeral field very broadly scalariform, the radiate veins below normal.

The single species known to me is *P. nigromarginata* from the Peruvian Andes, described by me (Proc. Bost. soc. nat. hist. 1875, v. 17, p. 268) as a species of *Machaerocera*. It is of small size.

The last genus in this division of the *acrolophitinae* is founded upon a single female specimen, not in the most satisfactory condition, from California.

## GYMNES (γυμνής*) gen. nov.

Body rather slender, compressed. Head relatively rather large, no broader beneath than above, as a whole nearly twice as high as broad, when viewed in front; vertex gently convex, transversely and longitudinally, the curve of the latter terminating at the front edge of the eyes, in front of which the fastigium is horizontal; the latter deeply and broadly sulcate with distinct bounding walls which are parallel on the hinder, convergent on the front half, the front strongly rounded; a median carina runs through the entire length of the fastigium, most distinct on the anterior half; face subdeclivent, more strongly in front of the eyes than below, the upper part of the frontal costa forming with the fastigium of the vertex less than a right angle; frontal costa rather narrow, pinched at extreme summit to a mere lamina, below subequal, slightly contracted immediately below the ocellus, slightly sulcate throughout except on the lamina; lateral carina straight, sharp, regularly divergent, extending to the edges of the clypeus; lateral ocelli situated midway between the antennae and the upper corner of the eyes, the fastigia facing more outward than downward or forward. Eyes twice as high as broad, considerably longer than the infraocular portion of the genae. Antennae very short, only as long as the head and half the pronotum, moderately stout, all the joints beyond the second excepting the apical equal, pretty strongly depressed, punctate, the apical joint half as broad, bluntly conical.

Prothorax with the prozona and metazona of subequal length, the former of equal width, rounded subtectiform transversely, the latter tumid and tapering forward considerably; median carina slight but distinct throughout, somewhat subdued on the posterior half of the prozona; lateral carinae on the metazona only terminating at the normal sulcus; two slight but continuous and gently sinuate transverse sulci on the prozona, the anterior not passing into the lateral lobes; these have the anterior and posterior margins straight, slightly convergent, the lower posterior angle rectangulate but rounded, the lower margin horizontal, barely inclined upwards anteriorly, so that the plate below is scarcely at all exposed. Metasternal lobes transversely quadrate, scarcely nearer together than the mesosternal lobes (♀). Tegmina slender, slightly tapering, scarcely coriaceous excepting at the extreme base where only the reticulation is at all dense, being elsewhere very open. Mediastinal area almost entirely free from cross nervures or reticulation of any kind except apically; intercalary vein present, discoidal vein unbranched, axillary vein impinging on the anal. Wings not large, simple and normal. Hind legs long and slender, the superior and inferior carinae of the femora well developed; hind tibiae with a dozen spines in the exterior row; calcaria moderately long; basal joint of hind tarsi not more than twice as long as second.

A single species is at hand.

### GYMNES PUNCTATUS sp. nov.

Pallid, apparently yellowish green in life. Almost entirely immaculate, the only dark markings of the body being the obscure brownish fuscous median carina of the pronotum, and the blackish fuscous posterior third of the metazona. Tegmina with six or eight small, roundish, brownish fuscous spots arranged by pairs transversely at tolerably regular intervals beginning at the middle of the basal half. Wings very delicate, translucent. Hind femora with slight narrow infuscations beyond the middle and at tip; spines of hind tibiae black-tipped.

The surface is generally nearly smooth, and a little lustrous on the pronotum which is also feebly and rather delicately punctate especially on the metazona, the lateral lobes being quite smooth on the prozona; the sides of the head are also feebly subrugose but

* In allusion to the very short subensiform antennae.

none the less shining, and the lower part of the face is slightly punctate.

Length of body 17 mm.; including closed tegmina 21 mm.; of antennae, 4.5 mm; tegmina 15.5 mm; hind femora 12 mm.

Unfortunately I have but a single specimen, the colors bleached from immersion in alcohol. It is a ♀ and was taken at Tighes, California, I believe during one of the explorations under Capt. Wheeler.

There remain the genera of the other division of *acrolophitinae* which by their gross form, hollowed dorsum of the metazona, long hind tarsi, and short frontal costa, are widely separated from the genera we have considered. Of these I know *Daemonea* only from Saussure's description, and can only refer thereto, but of

HIPPACRIS Scudder,

established on a Peruvian insect, I have before me two species closely resembling each other and yet widely distinct, which may be distinguished as follows:—

Antennae (of ♀ at least) nearly or quite half as long again as head and pronotum together, tapering regularly; tegmina relatively slender, being fully four times as long as broad; plates of the ovipositor of normal form .............................. *crassa*.
Antennae (of ♀ at least) apparently not much longer than head and pronotum together, several neighboring joints in two groups near the middle enlarged and depressed, forming broader areas; tegmina relatively stout, being less than three times as long as broad; plates of the ovipositor reduced to simple, straight, tapering, compressed laminae without armature *picticornis*.

To the first species, *H. crassa*, described by me (Proc. Bost. soc. nat. hist., 1875, v. 17, p. 268) from the eastern slope of the Peruvian Andes, I have nothing to add, as the single female then seen is still the only one known to me. The other from the opposite side of the Andes may be called

HIPPACRIS PICTICORNIS sp. nov.

Nearly uniform dull leaf brown. Head punctate, but obscurely excepting on the lower half. Antennae brownish luteous, with the first and second, ninth and tenth, thirteenth to sixteenth and most of seventeenth joints black, the basal joint brownish luteous on the inner upper surface, the ninth and succeeding joints punctate and of these the black joints depressed and wider than the others. Pronotum with the crested lateral carinae of the prozona and the hinder edge margined with black, and just above the posterior lower angle of the lateral lobes a small round luteous spot margined with blackish. Tegmina with all the longitudinal veins, except in the apical fourth, luteous. Wings faint fuliginous, all the veins blackish fuscous, and a blackish fuliginous cloud along the edges of the tip. Hind femora blackish at extremity on the outer side; hind tibiae luteo-fuscous, the spines dull luteous, black-tipped, the tarsi dull luteous.

Length of body 31 mm.; including closed tegmina 36 mm.; of antennae (broken beyond 19th joint) 17 mm.; of tegmina 26 mm.; width of same in middle 10 mm.; hind femora 15.5 mm.; tibiae 13 mm.; tarsi 8 mm.

Upper Amazons, Brazil. One ♀.

The most remarkable thing about this species is the manner in which it differs from the other species and indeed from all *acridiodea* I have examined in the structure of the ovipositor. Normally,

as is well known, these parts are principally composed of an upper and a lower pair of oppositely curved, stout, falcate hooks, serving as scrapers, working in opposite directions in boring or rather scratching a vertical hole in the earth in which to deposit eggs. Plainly the oviposition of this creature must be something quite different and very likely analogous to that of the *locustodea*, for these hooks or scrapers are reduced to a couple of sets of straight, compressed, tapering, bluntly pointed laminae, entirely without serrations or armature of any kind, and attingent only at tip, the upper pair the larger. They would appear to be useful only in crowding eggs into already existing crevices of wood or bark. Such a difference in sexual armor between two closely allied species I have never before seen.

Another point of interest in the species is the somewhat unusual contrasts of color and somewhat vivid color, especially in the antennae, in an insect which otherwise by its monochrome of dead leaf brown would seem to be gaining defence by avoiding vividness and contrast. Such are some of the anomalies in nature.

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### Lowne's Anatomy of the Blow-fly

The first part of Lowne's Anatomy, Morphology and Development of the Blow-fly has just appeared. The prospectus announced five quarterly parts each with about 64 pages of letterpress four plates and some 20 original drawings. As usual, however, the first part runs beyond anticipations, containing 98 pages. The introductory matter of 31 pages gives a life history of Calliphora, an introduction to insect anatomy in general and the broad characteristics of the Diptera and its subdivisions; while the body of the part is given up to the anatomy of the larva; half a dozen brief topical bibliographies are scattered through the Part and a brief appendix gives methods for histological work.

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### Hydrocyanic Acid Secreted by Polydesmus virginiensis, Drury.

Guldensteeden-Egeling has shown (Pflüger's Archiv f d. ges physiol., 1882, v. 28) that *Paradesmus* (*Fontaria*) *gracilis*, Koch, a myriopod indigenous to the Fiji Islands, Moluccas, etc., but which has now become acclimatized in some of the hot-houses of Europe, produces a secretion that contains, besides benzaldehyd free hydrocyanic acid. In the same year Weber (Archiv f. mikr, anat., v. 21.) showed that the repugnatory glands which produce the secretion open near the median dorsal line on certain segments and that it is only from these segments tha the characteristic odor of prussic acid is diffused. Haase in a recent note, from which I have taken these bibliographical references, has again called attention to this curious secretion (Sitzungs b. d. Gesell. naturf. Freunde zu Berlin, Jahrgang 1889. p. 97.)

While collecting specimens of our native *Polydesmus* (*Fontaria*) *virginiensis*, a myriopod not uncommon in some parts of Wisconsin and probably in many of the middle states, I observed that when roughly handled they emitted an odor like bruised peach-leaves or cyanide of potassium. Suspecting the presence of a secretion like that of the Moluccan species, I requested a professional chemist, Mr. Davenport Fisher of Milwaukee, to test the myriopods for free hydrocyanic acid. Mr. Fisher succeeded in establishing the presence of a small quantity of the highly poisonous substance. Subsequently I found it easy to make the test for myself. A few of the *polydesmi* were ground up in a mortar with a small quantity of water. A few drops of potassium hydrate and ferrous sulphate were then added to the solution obtained by filtering the mass. On the application of gentle heat and the further addition of a little ferric chloride with sufficient hydrochloric acid to dissolve the precipitated ferrous and ferric hydrates, the faint but distinct tinge of Prussian blue attested the presence of free hydrocyanic acid.

*W. M. Wheeler.*

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